Final
Feasibility Study Report
for the Eighteenmile Creek Corridor Site (Site 932121) and Adjacent Upland Properties (Water Street Residential Properties, Former United Paperboard Company, White Transportation, and Upson Park)

City of Lockport, New York

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Prepared for:
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List of Abbreviations and Acronyms

AMSL	above mean sea level
ARAR	applicable or relevant and appropriate
BCD	Base Catalyzed Decomposition
BGS	below ground surface
BUD	Beneficial Use Determination
ºC	degrees Celsius
CAD	contained aquatic disposal
CDFs	confined disposal facilities
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm/sec	centimeters per second
COC	contaminant of concern
CSO	combined sewer overflow
CY	cubic yards
DER	Division of Environmental Remediation
EEEPC	Ecology and Environment Engineering, P.C.
EPA	(United States) Environmental Protection Agency
ESA	Environmental Site Assessment
ESMI	Environmental Soil Management Inc.
ºF	degrees Fahrenheit
FRTR	Federal Remediation Technologies Roundtable

List of Abbreviations and Acronyms (cont.)

FS	Feasibility Study
FWIA	Fish and Wildlife Impact Analysis
GPS	Global Positioning System
GRA	general response action
HHRE	Human Health Risk Evaluation
HTTD	high-temperature thermal desorption
ICs	Institutional Controls
ISTD	In situ thermal desorption
ISV	In situ vitrification
LEL	lowest effect level
LTM	long-term monitoring
LTTD	low-temperature thermal desorption
mg/kg	milligrams per kilogram
MNR	monitored natural recovery
NCHD	Niagara County Health Department
NCP	National Contingency Plan
NCSWCD	Niagara County Soil and Water Conservation District
NFESC	Naval Facilities Engineering Service Center
NWI	National Wetland Inventory
NYCRR	New York Codes, Rules, and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response

List of Abbreviations and Acronyms (cont.)

OU	operable unit
PAH	polycyclic (or polynuclear) aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene
PISCES	Passive In Situ Chemical Extraction Sampler
POTW	Publicly Owned Treatment Works
PPE	personal protective equipment
ppm	parts per million
PRAP	Proposed Remedial Action Plan
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SCGs	standards, criteria, and guidelines
SCO	soil cleanup objective
SEL	severe effect level
SEQR	State Environmental Quality Review Act
SITE	Superfund Innovative Technology Evaluation
SPDES	State Pollutant Discharge Elimination System
SRI	Supplemental Remedial Investigation
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TBC	to be considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure

List of Abbreviations and Acronyms (cont.)

TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
VOC	volatile organic compound
WWTP	wastewater treatment plant

1 Introduction

1.1 Purpose and Approach

Ecology and Environment Engineering, P.C. (EEEPC) performed a Feasibility Study (FS) at the Eighteenmile Creek Corridor Site (Site No. 932121) and adjacent upland properties (herein referred to as the Site). The Eighteenmile Creek Corridor Site is located between the New York State Barge Canal (Barge Canal) and Harwood Street in the city of Lockport, Niagara County, New York. The adjacent upland properties include the Water Street residential properties and the Upson Park, White Transportation, and Former United Paperboard Company properties. This work was performed under the State Superfund Contract Work Assignment No. D004435-019 accepted by EEEPC on September 27, 2006, from the New York State Department of Environmental Conservation (NYSDEC), Division of Environmental Remediation (DER).

EEEPC developed this FS for the Site based on the contamination in the various media identified in the Remedial Investigation (RI) (NYSDEC 2006a), Supplemental Remedial Investigation (SRI) (EEEPC 2009b) and the Additional Investigation (EEEPC 2009a), including contamination in sediments in Eighteenmile Creek and the millrace as well as contamination in soils found on the properties adjacent to the creek that have the potential to transport to the creek.

As per discussions with NYSDEC, the Site has been divided into six Operable Units (OUs) as follows: OU-1: Eighteenmile Creek Corridor and millrace Sediments; OU-2: Former Flintkote Plant site; OU-3: Former United Paperboard Company property; OU-4: Upson Park property; OU-5: White Transportation property; and OU-6: Water Street Residential Properties (Figure 1-1). This FS report includes all of these OUs, with the exception of OU-2: Former Flintkote Plant site, included as a separate Site Investigation Report (TVGA 2005), the Remedial Alternatives Report (TVGA 2005), and the Record of Decision (ROD) (NYSDEC 2006b), which have already been completed for the soils at this site. The creek and millrace sediments within the extent of the Former Flintkote Plant site are included in this FS under OU-1. However, it is noted that remedial efforts of the six OUs will need to be coordinated and therefore, the selected remedial action for OU-2 was considered in the development of this report.

The purpose of this FS is to identify and evaluate technologies that are applicable to the areas identified in the RI and SRI as requiring remedial action(s). The technologies most appropriate for the site conditions are then developed into remedial action alternatives that are evaluated based on their environmental benefits and cost. The information presented in an FS report is typically used by NYSDEC to select on-site remedial action(s). The on-site remedial action(s) selected would then be summarized by NYSDEC in a Proposed Remedial Action Plan (PRAP), which would be released for public comment. After receipt of public comment, NYSDEC would issue a ROD.

The development of this FS follows the NYSDEC goal to be protective of human health and the environment. The FS was conducted in general accordance with the following documents:

- NYSDEC, Division of Environmental Remediation, *Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2002);
- New York State Codes, Rules and Regulations Part 375, *Environmental Remediation Programs* (NYSDEC 2006c);
- U.S. Environmental Protection Agency (EPA), *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988);
- NYSDEC Final Technical Administrative Guidance Memorandum No. 4030, *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC 1990); and
- The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300).

1.2 Report Organization

As mentioned above, this FS identifies and evaluates remedial alternatives for OU-1, OU-3, OU-4, OU-5, and OU-6. The following is an outline of the report in its entirety:

- Section 1 – Introduction
- Section 2 – OU-1: Eighteenmile Creek and Millrace
- Section 3 – OU-3: Former United Paperboard Company;
OU-4: Upson Park; and
OU-5: White Transportation
- Section 4 – OU-6: Water Street Residential Properties
- Section 5 – Conclusions
- Section 6 – References

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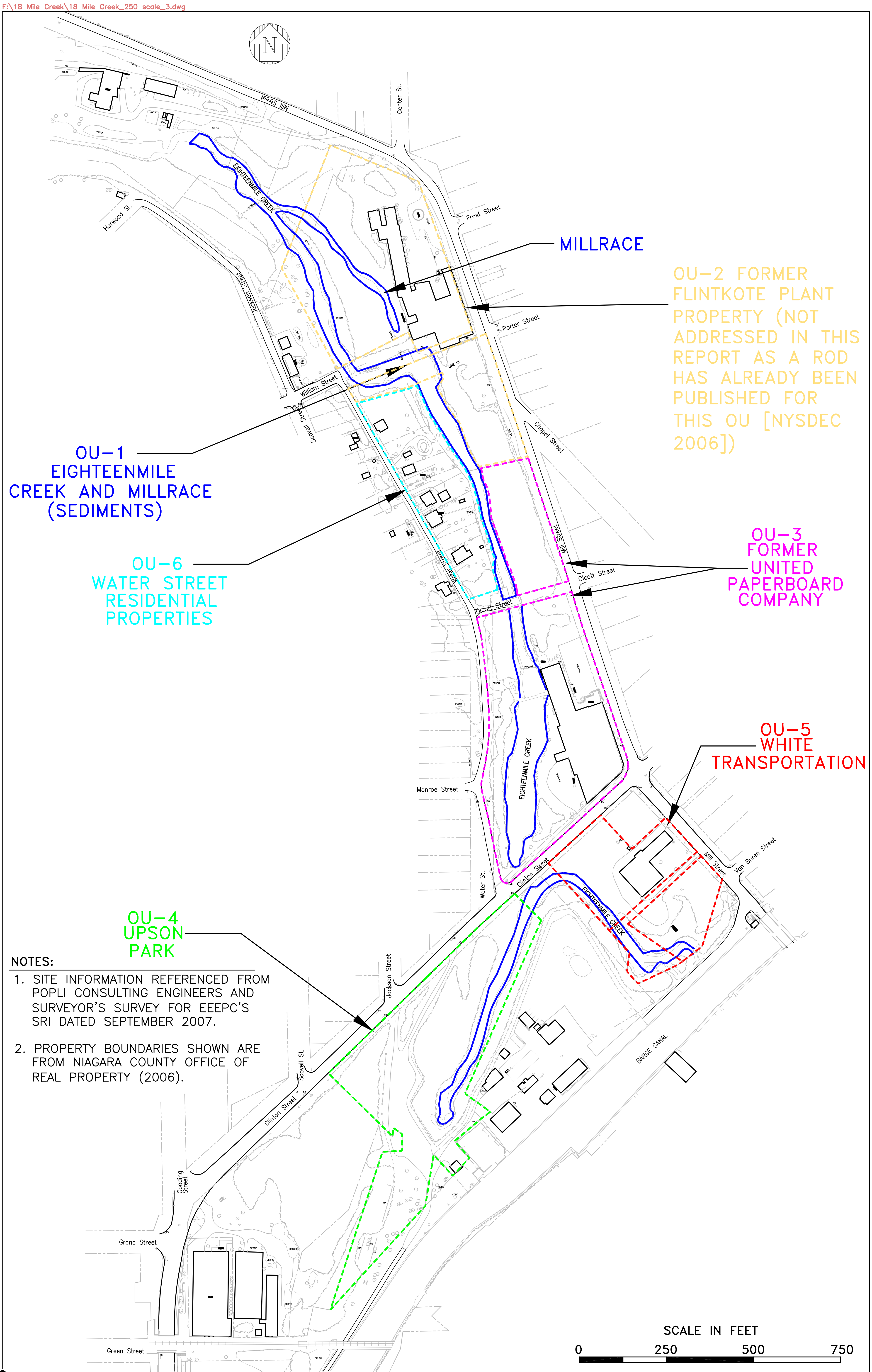

FIGURE 1-1 – OPERABLE UNIT BOUNDARIES, EIGHTEENMILE CREEK CORRIDOR SITE, LOCKPORT, NEW YORK

Sections 2, 3, and 4 each present a complete FS analysis for the selected OUs, including establishing remedial action objectives (RAOs), identifying general response actions (GRAs), identifying and screening appropriate technologies, and developing and analyzing the selected alternatives. As per discussion with NYSDEC, OU-3, OU-4, and OU-5 are presented together because the contaminants of concern (COCs), contaminated media, and land use of these properties are similar. It is expected that remedial alternatives for these properties will be similar.

Section 5 presents conclusions for the Site as a whole, drawing together each of the OUs. It should be noted that this FS presents a preliminary analysis of remediation for costing purposes. Details regarding phasing of construction for each of the OUs will need to be addressed in the remedial design phase.

2 OU-1: Eighteenmile Creek and Millrace Sediments

2.1 Introduction

This section of the report discusses the nature and extent of contamination and the feasibility of remedial alternatives for OU-1: Eighteenmile Creek and millrace sediments. This OU consists of a stretch of approximately 4,000 feet of Eighteenmile Creek as well as the millrace which flows adjacent to the Former Flintkote Plant site. For purposes of this report, the boundary of the OU-1 site is defined as sediments located in Eighteenmile Creek from the Barge Canal to approximately 350 feet northwest of the northern boundary of the Former Flintkote Plant site as shown on Figure 2-1. The width of the creek to be addressed in this OU is defined by the bankfull elevation that was delineated in November 2008 (EEEPC 2009a) and is shown on Figure 2-1.

This section includes the following:

- A summary of the site background from the RI and SRI;
- Establishing the remedial goals and RAOs (Section 2.2);
- Identifying GRAs (Section 2.3);
- Identifying and screening appropriate technologies (Section 2.3); and
- Developing and analyzing the remedial alternatives (Sections 2.4 and 2.5).

2.1.1 Site Background

The headwaters of Eighteenmile Creek (north of the Barge Canal in Lockport, New York) originate from two branches (East and West) immediately north of the Barge Canal. Waters from the East Branch originate at the spillway in the Barge Canal near the Mill Street bridge. At the bridge, canal waters join with water from the culverted section of Eighteenmile Creek south of the Barge Canal. These waters flow north under the Barge Canal near Mill Street toward Clinton Street. The waters from the West Branch originate from the dry dock on the north side of the Barge Canal and flow north toward Clinton Street. Waters from the East and West Branch converge on the south side of Clinton Street and flow under Clinton Street to the Mill Pond on the north side of Mill Street. The Mill Pond is the result of a dam on the adjacent Former United Paperboard Company property (see Figure 1-1). The waters from Eighteenmile Creek eventually discharge to Lake Ontario in Olcott, New York.

Eighteenmile Creek, located in the heart of Niagara County, is surrounded by six residential townships, and many citizens own creek-front property. The creek is used extensively for fishing, boating, and recreation and is considered a class D waterbody in the Site segment. Adjacent to OU-1 are several commercial and industrial properties as well as several residential properties situated along Water Street. These adjacent, upland properties have been identified as potential sources of contamination to the creek and are addressed separately in later sections of this report.

2.1.2 Site Geology and Hydrology

The Eighteenmile Creek watershed is located within both the Ontario and Huron Plains, two relatively flat plains that are separated by the Niagara Escarpment, which runs generally east and west along the northern portion of the city of Lockport. Within the Ontario Plain (from Lake Ontario to the Niagara Escarpment) elevations range from approximately 245 feet above mean sea level (AMSL) at the shoreline to approximately 400 feet AMSL at the toe of the escarpment. Within the watershed area the escarpment ranges from 100 to 175 feet. The maximum elevations within the watershed occur within the Huron Plain in the southern portion of the watershed and are approximately 635 feet AMSL in the southwestern portion and approximately 655 feet AMSL along the southeastern extent. Downstream of the Site, the gulf and the main branch of Eighteenmile Creek are both located within a well-incised, steeply sloped channel for most of their lengths. The channel walls range in height, but average approximately 35 feet. The East Branch lacks the incised channel characteristic of the rest of Eighteenmile Creek.

Eighteenmile Creek within the Site varies in size from tens of feet wide or less where the creek enters the Site to the south, to more than 50 feet wide in the mill pond along the Former United Paperboard Company property. In many areas, the creek bed along the center of the channel is comprised mostly of coarse sand and various sizes of gravel, stone, and rubble. A larger proportion of silt was observed along the creek bottom in the West Branch of the creek, as well as between Clinton Street and the Clinton Street Dam. In the East Branch of the creek, as well as downstream of the Clinton Street Dam, the creek bottom was largely composed of gravel and rubble. Water depth in the creek varied from a few inches in the southern-most point of the West Branch to around 10 feet in the center of the mill pond, along the Former United Paperboard Company property.

Drainage within the watershed can be described as generally flowing to the north. The East Branch of Eighteenmile Creek initially flows to the northeast, before turning west and joining with the main branch. This is caused by a topographic high point located in the southeastern portion of the watershed. The East Branch

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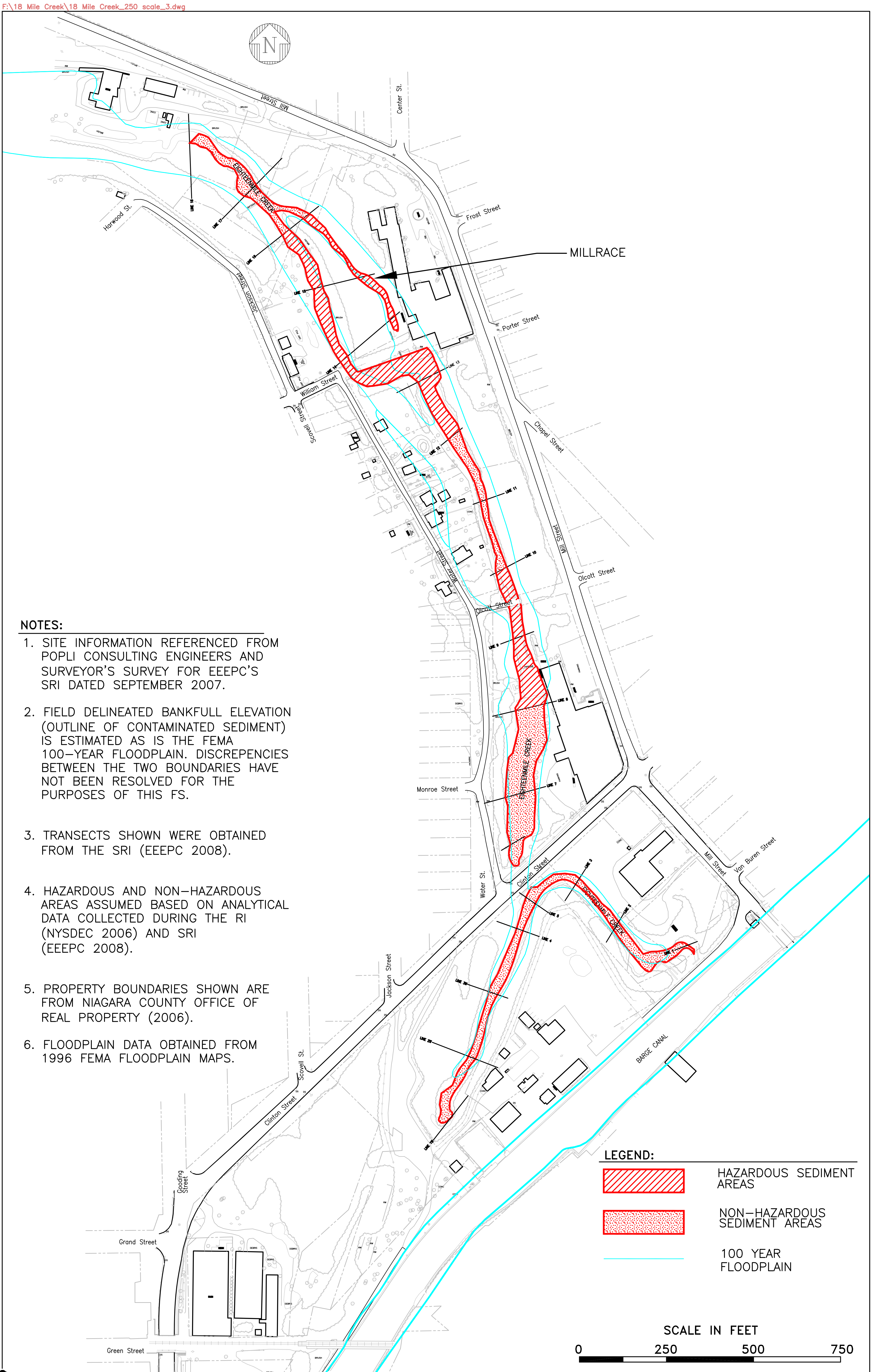

NOTES:

1. SITE INFORMATION REFERENCED FROM POPLI CONSULTING ENGINEERS AND SURVEYOR'S SURVEY FOR EEEPC'S SRI DATED SEPTEMBER 2007.

2. FIELD DELINEATED BANKFULL ELEVATION (OUTLINE OF CONTAMINATED SEDIMENT) IS ESTIMATED AS IS THE FEMA 100-YEAR FLOODPLAIN. DISCREPENCIES BETWEEN THE TWO BOUNDARIES HAVE NOT BEEN RESOLVED FOR THE PURPOSES OF THIS FS.

3. TRANSECTS SHOWN WERE OBTAINED FROM THE SRI (EEEPC 2008).

4. HAZARDOUS AND NON-HAZARDOUS AREAS ASSUMED BASED ON ANALYTICAL DATA COLLECTED DURING THE RI (NYSDEC 2006) AND SRI (EEEPC 2008).

5. PROPERTY BOUNDARIES SHOWN ARE FROM NIAGARA COUNTY OFFICE OF REAL PROPERTY (2006).

6. FLOODPLAIN DATA OBTAINED FROM 1996 FEMA FLOODPLAIN MAPS.

LEGEND:

HAZARDOUS SEDIMENT AREAS

NON-HAZARDOUS SEDIMENT AREAS

100 YEAR FLOODPLAIN

SCALE IN FEET

0 250 500 750

ecology and environment

FIGURE 2-1 – EXTENT OF CONTAMINATION
OU-1: EIGHTEENMILE CREEK AND MILLRACE
LOCKPORT, NEW YORK

near the Barge Canal and White Transportation property has high flow, with water depth of 1 to 3 feet at mid-channel, and rocky bottom. The West Branch has moderate to high flow velocity in most places and a bottom composed of cobble, gravel, and sand. The East and West Branches of Eighteenmile Creek merge immediately upstream from Clinton Street and then flow north beneath Clinton Street into Mill Pond on the Former United Paperboard Company property. Near the Former Flintkote Plant site, the creek channel splits and flows around an island, with most of the flow following the channel on the west side of the island.

2.1.3 Nature and Extent of Contamination

A total of 61 sediment samples were collected in the creek and millrace during the RI (NYSDEC 2006a) followed by an additional 93 sediment samples collected during the SRI (EEEPC 2009b).

Polychlorinated biphenyls (PCBs) were found throughout the sediment samples with concentrations up to 237 parts per million (ppm) in the SRI and 1,400 ppm in the RI. Several sediment samples contained PCBs at concentrations greater than the screening level of 0.000023 ppm as presented in the SRI. Furthermore, seven samples collected at four locations during the RI and five samples collected at four locations during the SRI had PCB concentrations exceeding 50 ppm, thereby meeting the criteria for hazardous waste. The highest concentrations of PCBs in sediments tended to be located downstream of the Clinton Street Dam and in the creek and millrace adjacent to the Former Flintkote Plant site.

Arsenic, chromium, copper, lead and zinc were also found in creek sediments often at concentrations several times greater than the lowest effect levels (LEL) presented in the Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999). Concentrations of these metals exceeding screening levels were found throughout the site, with the highest concentrations located downstream of the Clinton Street Dam. Additionally, several sediment samples failed the toxicity characteristic leaching procedure (TCLP) test for lead, indicating the presence of hazardous sediments at the site. Polycyclic aromatic hydrocarbons (PAHs) were also prevalent in the sediment samples throughout the site.

2.1.4 Contamination Fate and Transport

2.1.4.1 Contaminant Sources to the Creek

The RI and SRI found concentrations of PCBs and metals in sediment exceeding screening criteria in the creek and the millrace as well as in the soils on the properties located adjacent to the creek. The SRI concluded that contaminated fill material on the adjacent properties via erosion and runoff appears to be the primary mechanism for transport of PCBs and lead contamination to the creek. In addition, subsurface utilities are another mechanism that could potentially allow the migration of contamination to OU-1.

The SRI indicated that the State Barge Canal is potentially a chronic source of PCB contamination to the creek. PCB contaminated sediment in the Barge Canal immediately upstream (to the west) of Eighteenmile Creek was identified by an investigation performed by URS Corporation in 2006, the RI, and to a lesser extent, during the SRI. The Additional Investigation (EEEPC 2009a) was conducted to determine whether the Barge Canal is a significant source of contamination to creek sediments. For purposes of this FS, this investigation concluded that the Barge Canal is not a significant contributor of PCBs and metals to Eighteenmile Creek sediments at the Corridor. Therefore, the likelihood of recontamination from the Barge Canal after creek sediments have been remediated is small. However, the investigation also concludes that one-time events, such as pulling the canal plug (allows water to drain from the Barge Canal to the Creek) and significant discharges from combined sewer overflow (CSO) outfalls were not evaluated in the investigation. Such events could cause a slug of potentially contaminated sediments to the creek. For purposes of this FS, it is assumed that a sediment release from pulling the canal plug could be avoided through operational changes (i.e., use of pumps) to prevent such a potential slug release to the creek. CSOs are being monitored under NYSDEC Division of Water, and it is therefore assumed that the sediment levels in the sewer system are being monitored for COCs for Eighteenmile Creek.

Review of the history of the Site indicates the presence of a storm sewer crossing the creek approximately 25 to 50 feet downstream of the Clinton Street Dam. In addition, several combined storm/sanitary sewer manholes were observed on both banks (east and west) of the creek and have been identified as a potential source of PCB and metals contamination to the creek. *The Niagara County Soil and Water Conservation District (NCSWCD) Eighteenmile Creek Remedial Action Plan* (NCSWCD 2007) summarized that there are currently 12 CSO outfalls with the potential to negatively impact the creek. Passive In Situ Chemical Extraction Sampler (PISCES) sampling conducted during NYSDEC's 2001 PCB trackdown study of the city of Lockport sewer system suggests that these outfalls are potentially active sources of PCBs (NYSDEC 2001). Although PCBs are not readily soluble in water, water flowing through pipe bedding containing PCB-laden particles can provide a means of transport for these particles into or from the creek and potentially beyond the Eighteenmile Creek Corridor.

2.1.4.2 Contamination in the Creek

Surface water flow at the site potentially allows lateral migration of sediments to downstream segments of Eighteenmile Creek. The creek draws much of its flow from the Barge Canal but also receives contributions from upstream areas within the watershed of the creek and surface runoff during precipitation events or spring snowmelts. During periodic flooding events, there is the potential for sediments to migrate upland and contaminate floodplain soils.

2.1.5 Qualitative Human Health Risk Assessment

A qualitative human health exposure risk assessment identified receptors with different potentials for human exposure to contaminants in OU-1. These receptors include residents along Water Street, visitors to the Eighteenmile Creek Corridor Site, and anglers. The SRI concluded that direct contact and incidental ingestion of contaminated creek sediments is the main exposure pathway for these receptors.

2.1.6 Qualitative Ecological Risk Assessment

The ecological risk assessment determined that the Eighteenmile Creek Corridor Site contains aquatic and terrestrial habitats capable of supporting a wide variety of aquatic organisms and wildlife. Direct contact or incidental ingestion of contaminated sediments by ecological receptors or through food chains for these organisms was determined to be the potential exposure pathway.

2.2 Identification of Remedial Action Objectives and Standards, Criteria, Guidelines

This section identifies the COCs and media of interest specific to OU-1. This section also establishes proposed cleanup goals and specific RAOs for contaminated on-site media and presents estimates of volumes of contaminated media.

2.2.1 Remedial Action Objectives

Based on sampling conducted during the RI (NYSDEC 2006a) and SRI (EEEPC 2009b), metals, PCBs, and semivolatile organic compounds (SVOCs) contamination was found in sediments throughout Eighteenmile Creek and the Flintkote millrace. Accordingly, potential risks and exposure routes posed by site contamination were identified. This evaluation was conducted for both human and environmental receptors.

The evaluation identified the following potential risks at the site:

- Ingestion or direct contact exposure to contaminated sediment by residents, anglers, or site visitors;
- Incidental ingestion of contaminated site sediments by birds, mammals, and reptiles; and
- Direct contact or incidental ingestion of contaminated site sediments or through the food chain to fish, amphibians, and benthic invertebrates.

Surface water samples were not collected as part of the RI or SRI, so contaminant concentrations in surface water are unknown. However, it is assumed that active remediation of contaminated creek sediments and soils on the upland properties will indirectly improve the surface water quality through source reduction. Surface water will not be addressed further in this FS.

Additionally, groundwater as a media will also not be addressed in this FS as sampling results from the SRI (EEEPC 2009b) did not contain detections of site-related COCs (PCBs and metals).

Development of RAOs

RAOs are goals set for environmental media such as sediment, soil, groundwater, and surface water (media-specific objectives) that are intended to protect human health and the environment. These RAOs form the basis for the FS by providing overall goals for site remediation. The RAOs are considered when identifying appropriate remedial technologies, formulating alternatives for the site, and during the evaluation of remedial alternatives. RAOs are based on engineering judgment, risk-based information established in the risk assessment, and potentially applicable or relevant and appropriate (ARARs) standards, criteria, and guidance.

The RAOs for each media were developed based on the nature and extent of contamination, consideration of qualitative human health risk evaluation, fish and wildlife impact assessment, and potentially ARAR standards, criteria, and guidelines (SCGs). The following RAOs were established for sediments in OU-1.

- Eliminate, to the extent practicable, direct contact with or ingestion of sediments by humans and ecological receptors;
- Eliminate, to the extent practicable, releases of sediment that would result in surface water levels in excess of ambient water quality criteria; and
- Eliminate, to the extent practicable, direct contact or ingestion of contaminated sediments by biota that would cause toxicity or impacts from bioaccumulation through the aquatic food chain.

2.2.2 Standards, Criteria, and Guidelines

Standards and *criteria* refer to promulgated and legally enforceable rules or regulations. *Guidance* refers to policy documents that are non-promulgated and, therefore, are not legally enforceable. SCGs include ARARs, and other criteria to be considered (TBC):

- **Applicable Requirements** are legally enforceable standards or regulations such as groundwater standards for drinking water that have been promulgated under state law.
- **Applicable or Relevant and Appropriate Requirements** include those requirements that have been promulgated under state law that may not be "applicable" to the specific contaminant released or the remedial actions contemplated but are sufficiently similar to site conditions TBC relevant and appropriate. If a relevant or appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.
- **To Be Considered Criteria** are non-promulgated advisories or guidance issued by state agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there

are no standards or regulations for a particular contaminant or site condition. These criteria may be considered with SCGs in establishing cleanup objectives for protection of human health and the environment.

There are three types of SCGs: chemical-specific, location-specific, and action-specific SCGs.

- **Chemical-Specific SCGs** are usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment. They are used to assess the extent of remedial action required and to establish cleanup objectives for a site. Chemical-specific SCGs may be directly used as actual cleanup objectives or as a basis for establishing appropriate cleanup objectives for the COCs at a site. Sediment specific cleanup objectives are presented in Section 2.2.3.

- **Location-Specific SCGs** are restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the activities occur in special locations. Examples of location-specific SCGs include building code requirements and zoning requirements. Location-specific SCGs are commonly associated with features such as wetlands, floodplains, sensitive ecosystems, or historic buildings that are located on or close to the site. See Table 2-1 for the location-specific SCGs for OU-1.

- **Action-Specific SCGs** are usually technology- or activity-based requirements that guide how remedial actions are conducted. These may include record-keeping and reporting requirements; permitting requirements; design and performance standards for remedial actions; and treatment, storage, and disposal requirements. Table 2-2 presents the action-specific SCGs for OU-1.

The following sections will account for SCGs in the selection of cleanup objectives, site COCs, and contaminated volumes.

2.2.3 Selection of Sediment Cleanup Objectives

Cleanup objectives are established by evaluating the available SCGs for each contaminant. The following sections describe the process used to select numeric cleanup objectives and estimate the volume of impacted material.

Standards and Criteria

There are no standards or criteria for the cleanup of sediments.

Guidance Values

Cleanup objectives identified for sediment contamination for OU-1 are contained in the Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999). This document presents two levels of risk for metals, which are the LEL and the severe effect level (SEL). The LEL is the most stringent of these guidance values and was, therefore, used as cleanup goals for metals. For organic compounds, including PCBs, the listed levels were calculated using the lower

Table 2-1 Location-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Location-Specific SCGs					
Environmental Conservation Law	Endangered and Threatened Species	6 NYCRR 182	Lists endangered and threatened species and species of special interest	Not Applicable	FWIA (EEEPC 2009b) indicates no occurrences of rare or endangered species at the site
	Freshwater Wetlands	6 NYCRR 663-665	Establishes permit requirement regulations, wetland maps and classifications	Not Applicable	FWIA (EEEPC 2009b) indicates no state wetlands within Corridor Site
	Floodplain Management Regulations Development Permits	6 NYCRR 500	Describes development permitting requirements for areas in floodplains	Applicable	Floodplain exists along Eighteenmile Creek
	Use and Protection of Waters	6 NYCRR 608	Regulates the modification or disturbance of streams	Applicable	
	Wild, Scenic, and Recreational Rivers	6 NYCRR 666	Regulations for administration and management	Relevant and Appropriate	
	Floodplains	6 NYCRR 502	Contains floodplain management criteria for state projects	Applicable	Floodplains exist along Eighteenmile Creek
Federal Location-Specific SCGs					
National Historical Preservation Act 16 USC Section 469	Preservation of archaeological and historical data	36 CFR Part 65	Action to recover and preserve artifacts	Relevant and Appropriate	
National Historical Preservation Act Section 106 (16 USC 470)	Historic landmarks, property, or projects owned or controlled by federal agencies	36 CFR Part 800	Preserve historic property, minimize harm to National Historic Landmarks	Relevant and Appropriate	
Endangered Species Act of 1973 16 USC 1531, 661	Endangered and Threatened species	50 CFR Part 200, 402 33 CFR Parts 320-330	Determine presence and conservation of endangered species	Not Applicable	FWIA (EEEPC 2009b) indicates no current records of federally-listed endangered species at the Site
Clean Water Act Section 404	Wetland Protection	40 CFR Parts 230 33 CFR Parts 320-330	Action to prohibit discharge into wetlands	Not Applicable	No federal wetlands at the Corridor Site

Table 2-1 Location-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Clean Water Act Part 6 Appendix A	Wetland Protection	40 CFR Part 6 Appendix A, section 4	Avoid adverse effects, minimize potential harm, preserve and enhance wetlands	Not Applicable	No federal wetlands at the Corridor Site
Floodplain Management	Executive Order No. 11988	40 CFR 6.302 (b) (2005)	Regulates activities in a floodplain	Applicable	Floodplains exist at the Corridor Site

Key:

CFR = Code of Federal Regulations.
FWIA = Fish and Wildlife Impact Analysis.
NYCRR = New York Codes, Rules and Regulations.
SCG = Standards, criteria, and guidelines.

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Local Action-Specific SCGs					
Lockport City Code	Demolition of Buildings	Chapter 68	Involves permitting and requirements for removal of buildings and structures	Applicable	Applicable to the removal of dams and structures within OU-1
	Environmental quality review	Chapter 92	General regulations regarding environmental projects conducted within the city; requires enforcement of 6 NYCRR 617	Applicable	
	Noise	Chapter 125	Places restrictions on unnecessary noise during certain time periods	Applicable	Restrictions on noise from construction equipment/vehicles
	Parks	Chapter 129	Regulates various activities conducted in city parks	Applicable	Applicable to activities conducted at the Upson Park property
	Sewers	Chapter 150	Regulates discharge of waters to city sewers	Relevant and Appropriate	
	Streets and Sidewalks	Chapter 158	Regulates alterations of roads and sidewalks including excavation, widening, etc.	Relevant and Appropriate	
	Trees	Chapter 176	Regulates cutting down and planting trees on public land	Applicable	Applicable to clearing and restoration activities along Upson Park property
	Vehicles and Traffic	Chapter 183	Places restrictions on vehicle traffic throughout the city, and defines truck routes and weight limits on certain streets	Applicable	Applicable to any transporting of wastes off site by vehicles on city roads
	Water	Chapter 185	Places restrictions on access and use of city water mains	Relevant and Appropriate	Relevant and appropriate to construction activities or technologies requiring access to water

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Action-Specific SCGs					
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law Articles 3 and 19.	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels	Applicable	Applicable to noise from over-the-road vehicles
Environmental Conservation Law, Articles 3 and 19	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200 - 202	Establishes general provisions and requires construction and operation permits for emission of air pollutants	Relevant and Appropriate	
Environmental Conservation Law, Article 15; also Public Health Law Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257	Part 256: New York Ambient Air quality Classification System Part 257: Air quality standards for various pollutants including particulates and non-methane hydrocarbons	Applicable	Applicable to remediation activities at the site that include a controlled air emission source
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions; includes identification of "beneficial use" potentially applicable to non-hazardous oily waste/soil (360-1.15). 360-2: Regulates construction and operation of landfills, including construction and demolition debris landfills	Applicable	Applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous sediment and debris
New York Waste Transport Permit Regulations	Permitting Regulations, Requirements, and Standards for Transport	6 NYCRR 364	The collection, transport and delivery of regulated waste, originating or terminating at a location within New York, will be governed in accordance with Part 364	Applicable	Applicable for transporting wastes off site
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System - General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 - 374, 376	Applicable	Hazardous wastes have been identified at the site

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste (PCBs and metals) and lists specific wastes	Applicable	Applies to transportation and all other hazardous waste management practices in New York State. Applicable as hazardous wastes have been identified on site (PCB and lead contaminated sediments)
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and record keeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities	Applicable	Applicable to transportation of hazardous material offsite
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage, and disposal of hazardous waste	Applicable	Applicable to off-site treatment/disposal of hazardous waste
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes	Applicable	Hazardous wastes have been identified at OU-1
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act Articles 301 and 305	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry sites; provides exception from NYSDEC permits.	Applicable	
Environmental Conservation Law, Articles 3 and 27	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes that are restricted from land disposal. Defines treatment standards for hazardous waste.	Applicable	Hazardous wastes have been identified at OU-1

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
New York Environmental Quality Review Regulations		6 NYCRR 617	Implements provisions of State Environmental Quality Review Act	Applicable	
Implementation of SPDES Program in New York	General Permit for Stormwater	6 NYCRR 750 – 758	Regulates permitted releases into waters of the state	Applicable	
Primary and Principal Aquifer Determinations (5/87)		NYSDEC TOGS 2.1.3	Provides guidance on determining water supply aquifers in upstate New York	Not Applicable	There are no primary aquifers in Niagara county
Environmental Justice and Permitting	Environmental Justice	Commissioner Policy 29	Policy incorporates environmental justice concerns into NYSDEC's public participation provisions and application of the State Environmental Quality Review Act (SEQR)	Applicable	
Federal Action-Specific SCGs					
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions	Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations. Includes training requirements and construction safety requirements	Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities that fall under jurisdiction of the National Contingency Plan
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination with Other Agencies	Delegates authority contained in CERCLA and the NCP to federal agencies	Relevant and Appropriate	

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb)	Applicable	Applicable to emissions from equipment and remediation systems
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants; Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants	Applicable	Applicable to emissions from equipment and remediation systems
Toxic Substances Control Act	Rules for Controlling PCBs	40 CFR 761	Provides guidance on storage and disposal of PCB-contaminated materials	Applicable	PCBs are contaminants of concern at the site
RCRA	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste	Relevant and Appropriate	Relevant and appropriate to disposal at offsite solid waste landfills
	Hazardous Waste Management System - General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268	Applicable	Applicable to remedial alternatives that involve generation of a hazardous waste (e.g., contaminated soil)
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes that are subject to regulation as hazardous wastes	Applicable	
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste	Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards that apply to persons transporting manifested hazardous waste within the United States	Applicable	Applicable to alternatives involving off-site disposal of hazardous wastes
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards that define acceptable management of hazardous waste	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Standards for Owners of Hazardous Waste Facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities

Table 2-2 Action-Specific SCGs, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Hazardous Waste Permit Program	40 CFR 270, 124	EPA administers hazardous waste permit program for CERCLA/Superfund Sites. Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
Clean Water Act	EPA Pretreatment Standards	40 CFR 403	Establishes responsibilities of federal, state, and local government to implement National pretreatment standards to control pollutants that pass through to a POTW	Relevant and Appropriate	Relevant and appropriate to discharge made to a POTW

Key:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
CFR = Code of Federal Regulations.
EPA = (United States) Environmental Protection Agency.
NYCRR = New York Codes, Rules and Regulations.
NYSDEC = New York State Department of Environmental Conservation.
OSHA = Occupational Safety and Health Administration.
OU = Operable Unit.
PCB = Polychlorinated biphenyl.
PCE = Perchloroethylene.
POTW = Publicly Owned Treatment Works.
RCRA = Resource Conservation and Recovery Act.
SCG = Standards, criteria, and guidelines.
SEQR = State Environmental Quality Review Act
SPDES = State Pollutant Discharge Elimination System.
TCE = Trichloroethylene.
TOGS = Technical and Operational Guidance Series.

confidence limit of total organic carbon measured in site sediments (28,834 milligrams per kilogram [mg/kg]) and the most stringent guidance values of Human Health, Benthic Acute Toxicity, Benthic Chronic Toxicity, and Wildlife Bioaccumulation were selected.

Guidance values for contaminants detected at this site are presented in Table 2-3.

Background

Background sediment sample data are used to ensure that cleanup objectives are not set below background levels. Although site background values were not collected during the SRI, sediment samples were collected upstream of the Corridor Site before flow to the creek is augmented by waters from the New York State Barge Canal. For the purpose of this study, it is assumed that these samples represent background conditions and, therefore, site background concentrations presented in Table 2-3 are the average values of these two upstream sediment samples.

Selection Process

The selected cleanup objectives for sediments are presented in Table 2-3. These values are used in the next section to calculate remedial volumes and, subsequently, cost estimates. The following criteria were used to select the preliminary cleanup values:

- The most stringent guidance values (the LEL values) were selected as objectives;
- Where guidance values were not available, site background concentrations were used as the cleanup objectives;
- The maximum observed concentration for each compound was then compared with the selected cleanup objective in order to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site-related and whether cleanup is warranted.

2.2.3.1 Selection of Contaminants of Concern

Based on the cleanup objectives selected above, it was determined that PCBs and select metals, in particular, arsenic, chromium, copper, lead, and zinc, are the primary COCs in sediments at OU-1.

Although the SRI indicated concentrations of some SVOCs (primarily PAHs) above selected cleanup goals, these concentrations were relatively similar to those detected upstream of the Corridor Site. The SRI determined that these levels of PAHs detected upstream were consistent with concentrations associated with urban runoff. Additionally, SVOC exceedances were generally co-located with samples exceeding selected cleanup goals for PCBs or the metals indicated above.

Table 2-3 Cleanup Goals for Sediments, OU-1: Eighteenmile Creek and Millrace, Eighteenmile Creek Corridor Site, Lockport, New York

Analyte	NYSDEC Guidance Values[a]	Draft NYSDEC Guidance Values[b]	Site Background[c]	Maximum Concentration[d]		Reference[e] RI	Reference[e] SRI	Selected Cleanup Goal
PCBs by Method 8082 (mg/kg)								
Total PCBs	0.000023	0.06	ND	1,400		X		**0.000023**
SVOCs by Method SW8270C (mg/kg)								
2-Methylnaphthalene	0.98	-	0.02	5.9			X	**0.98**
Acenaphthene	4	-	0.08	12			X	**4**
Anthracene	3.1	0.06	0.20	23			X	**3.1**
Benzo(a)anthracene	0.34	0.11	0.5	43			X	**0.34**
Benzo(a)pyrene	0.037	0.15	0.5	34			X	**0.037**
Benzo(b)fluoranthene	0.037	-	0.8	46			X	**0.037**
Benzo(k)fluoranthene	0.037	-	0.3	16			X	**0.037**
Bis(2-ethylhexyl) phthalate	5.8	239	0.7	22			X	**5.8**
Chrysene	0.037	0.17	0.6	43			X	**0.037**
Fluoranthene	29	0.42	1.7	120			X	**29**
Fluorene	0.23	0.08	0.09	13			X	**0.23**
Indeno(1,2,3-cd)pyrene	0.037	-	0.29	16			X	**0.037**
Naphthalene	0.86	0.18	0.02	17			X	**0.86**
Phenanthrene	3.4	0.2	0.9	120			X	**3.4**
Pyrene	28	0.2	1.1	68			X	**28**
TOTAL PAHs	NA	1.61	7.4	590			X	**7.4**
Pesticides by Method SW8081A (mg/kg)								
4,4'-DDD	0.00029	0.005	ND	0.062			X	**0.00029**
4,4'-DDE	0.00029	0.003	ND	0.85			X	**0.00029**
4,4'-DDT	0.00029	0.004	ND	0.056	J		X	**0.00029**
Aldrin	0.0029	-	ND	1.5	J		X	**0.0029**
alpha-BHC	0.0017	0.002	ND	0.041	J		X	**0.0017**
alpha-Chlordane	0.000029	0.003	ND	0.017	J		X	**0.000029**
beta-BHC	0.0017	0.002	ND	2.9	J		X	**0.0017**
delta-BHC	0.0017	0.002	0.0015	0.024	J		X	**0.0017**
Dieldrin	0.0029	0.002	0.023	1.8	J		X	**0.0029**
Endosulfan I	0.00086	0.002	ND	0.17	J		X	**0.00086**
Endosulfan II	0.00086	0.002	ND	0.008	J		X	**0.00086**
gamma-BHC (Lindane)	0.0017	0.002	0.017	0.61	J		X	**0.0017**
gamma-Chlordane	0.000029	0.003	ND	0.75	J		X	**0.000029**
Heptachlor	0.000023	0.002	0.024	0.33	J		X	**0.000023**
Heptachlor epoxide	0.000023	0.002	ND	0.0086	J		X	**0.000023**
Methoxychlor	0.017	-	ND	0.07	J		X	**0.017**
Metals by Method 6010/7471 (mg/kg)								
Arsenic	6	10	3.5	50.5	N	X		**6**
Chromium	26	43	10.0	1,200			X	**26**
Copper	16	32	16.5	54,900			X	**16**
Lead	31	36	21.1	25,400		X		**31**
Zinc	120	121	76	23,600	N	X		**120**

Notes:

Shaded items represent Contaminants of Concern (COCs)

[a] 1999, Technical Guidance for Screening Contaminated Sediments, NYSDEC Division of Fish, Wildlife, and Marine Resources, Albany, New York. The listed levels for organic compounds were calculated using the lower confidence limit of total organic carbon measured in the site sediments (28,834 mg/kg). The most stringent (lowest) available value of Human Health, Benthic Acute Toxicity, Benthic Chronic Toxicity, and Wildlife Bioaccumulation Criteria were used for screening organic compound data. The Lowest Effect Level was used for screening the metals data.

[b] Sediment Guidance Values for use in assessing contaminated sediment in New York State (Draft, not published yet).

[c] Site background values are assumed to be the average of the upstream sample (18MC-UP-S01-Z1 and 18MC-UP-S02-Z2) collected during the SRI (EEEPC 2008).

[d] Concentration listed is the maximum detected value from sediment samples collected during the SRI (EEEPC 2008) and RI (NYSDEC 2006).

[e] Maximum concentration for a particular contaminant was observed in data collected and reported in the RI (NYSDEC 2006) or SRI report (EEEPC 2008).

Key:

J = Estimated value.
mg/kg = Milligrams per kilogram.
N = Spike sample recovery or spike analysis is not within quality control limits (inorganics).
ND = Non-detect.
NYSDEC = New York State Department of Environmental Conservation.
OU = Operable Unit.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
RI = Remedial Investigation (NYSDEC 2006a).
SRI = Supplemental Remedial Investigation (EEEPC 2008).
SVOC = Semivolatile organic compound.

Therefore, remedial alternatives addressing the COCs will also indirectly address sediments with SVOC detections above SCG levels. As such, SVOCs (including PAHs) will not be considered primary COCs in sediments throughout the creek and millrace.

2.2.3.2 Determination of Contaminated Sediment Volumes

For purposes of this FS, the term "contaminated sediments" will refer to sediments with PCBs and/or metals exceedances above the selected cleanup goal values indicated in Table 2-3. Although the selected cleanup goal for PCBs is extremely low, a laboratory measurable objective for PCBs will be determined during the remedial design phase for verification of remediation. However, based on the extent of sediments with COCs exceeding the selected cleanup goal values, it was conservatively assumed that all sediments within the OU-1 boundary are contaminated. The vertical extent of contamination was based on sediment thickness measurements collected during the SRI. An approximate volume of contaminated sediment requiring excavation was calculated assuming the following:

- Extent of contamination was assumed to be the width of the creek to the bankfull elevation and extending from the Barge Canal to approximately 350 feet northwest of the northern boundary of the Former Flintkote Plant site. The bankfull elevation was delineated using a Global Positioning System (GPS) in late 2008 (EEEPC 2009a).

- Sediment volume was calculated as stream length × sediment thickness × bankfull width. It is noted that this volume is only an estimate due to the dynamic nature of sediment transport in the creek, this volume will inevitably change (increase or decrease) over time.
  - The creek length was broken down into segments between transects as defined in the SRI and as shown on Figure 2-1.
  - Sediment thickness was calculated based on measurements of the sediment thickness collected during the SRI sampling events. In the field, thickness was measured based on sample refusal. Sediment thicknesses were approximated between transects by averaging the thicknesses measured at sampling locations at the two transects. This average thickness was assumed uniform through the creek section (between the two transects).

The extent of contaminated sediment is illustrated in Figure 2-1. The total volume of contaminated sediment in Eighteenmile Creek, including both the East and West Branches and millrace, was estimated at 14,500 cubic yards (CY). The maximum thickness of sediment was approximately 4 to 5 feet. Of the 14,500 CY of contaminated sediments, approximately 500 CY is located along the millrace.

The SRI indicated the presence of hazardous material in OU-1 sediments, based on samples with PCB concentrations greater than 50 ppm and samples failing the TCLP test for lead. The SRI also concluded that there is no correlation between concentrations of metals in sediments and failure of TCLP tests. However, review of the data shows that hazardous material appears to be concentrated in a few select areas, as indicated on Figure 2-1. Therefore, the volume of hazardous waste was estimated based on the volume of sediment in these areas and is approximately 5,000 CY.

2.3 Identification and Screening of Technologies

This section presents the results of the preliminary screening of remedial actions that may be used to achieve the RAOs. Potential remedial actions, including GRAs and remedial technologies, have been evaluated during the preliminary screening on the basis of effectiveness, implementability, and relative cost. Past performance (e.g., demonstrated technology) and operating reliability were also considered in identifying and screening applicable technologies. Technologies that were not initially considered effective and/or technically or administratively feasible were eliminated from further consideration.

The purpose of the preliminary screening is to eliminate remedial actions that may not be effective, based on anticipated on-site conditions, or cannot be implemented technically at the site. The GRAs considered herein are intended to include those actions that are most appropriate for the site and, therefore, are not exhaustive.

2.3.1 General Response Actions

Based on the information presented in the SRI, RI and the RAOs established in Section 2.2.1, this section identifies GRAs, or classes of responses for contaminated sediment. GRAs describe classes of technologies that can be used to meet the remediation objectives for contaminated site media.

GRAs identified for contaminated sediment are presented by the EPA (EPA 2005) and are listed as:

- No action;
- Institutional controls (ICs);
- Monitored Natural Recovery (MNR);
- In situ capping;
- In situ treatment; and
- Removal technology.

2.3.2 Criteria for Preliminary Screening

In accordance with guidance documents issued by NYSDEC (DER-10 and Technical and Administrative Guidance Memorandum [TAGM] 4030) and the EPA (Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA [October 1988]), the criteria used for preliminary screening of GRAs and remedial technologies include the following:

- **Effectiveness.** The effectiveness evaluation focuses on the degree to which a remedial action is protective of human health and the environment. An assessment is made of the extent to which an action: (1) reduces the mobility, toxicity, and volume of contamination at the site; (2) meets the remediation goals identified in the RAOs; (3) effectively handles the estimated areas and volumes of contaminated media; (4) reduces impacts on human health and the environment in the short-term during the construction and implementation phase; and (5) has been proven or shown to be reliable in the long-term with respect to the contaminants and conditions at the site. Alternatives that do not provide adequate protection of human health and the environment are eliminated from further consideration.

- **Implementability.** The implementability evaluation focuses on the technical and administrative feasibility of a remedial action. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the site and the availability of necessary equipment and technical specialists. Technical feasibility also includes the future maintenance, replacement, and monitoring that may be required for a remedial action. Administrative feasibility refers to compliance with applicable rules, regulations, statutes, and the ability to obtain permits or approvals from other government agencies or offices and the availability of adequate capacity at permitted treatment, storage, and disposal facilities and related services. Remedial actions that do not appear to be technically or administratively feasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time are eliminated from further consideration.

- **Relative Cost.** In the preliminary screening of remedial actions, relative costs are considered rather than detailed cost estimates. The capital costs and operation and maintenance (O&M) costs of the remedial actions are compared on the basis of engineering judgment, where each action is evaluated according to whether the costs are high, moderate, or low relative to other remedial actions based on knowledge of site conditions. A remedial action is eliminated during preliminary screening on the basis of cost if other remedial actions are comparably effective and implementable at a much lower cost.

2.3.3 Screening of Remedial Technologies

This section identifies the potential remedial action technologies that may be applicable to remediation of sediments at OU-1. Table 2-4 summarizes the results from the screening of sediment remedial technologies. The following sections detail the screening-level evaluation of each technology considered.

2.3.3.1 No Action

The National Contingency Plan (NCP) at Title 40 Code of Federal Regulations (40 CFR) §300.430 (e) (6) provides that the No Action Alternative should be considered at every site. The No Action Alternative is only acceptable when it results in an acceptable risk to human health and the environment.

Table 2-4 Summary of Sediment Remedial Technologies, OU-1: Eighteenmile Creek and Millrace, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
Sediment Remedial Technologies			
No Action	No further action to remedy sediment conditions at the Site.	Required for inclusion in the FS per the NCP.	Yes
Insitutional Controls (ICs)	Non-engineering measures to reduce exposure to hazardous substances by limiting land or resource uses, including fish consumption advisories and commercial fishing bans, waterway use restrictions, and land use restriction/structure maintenance agreements.	ICs are not applicable as a stand-alone alternative; they will be retained for further consideration in conjunction with other remedial actions.	Yes
Monitored Natural Recovery	Reduce risk by using ongoing, naturally occurring biological, chemical, and/or physical processes, such as sorption increase and dispersion.	Ineffective for the natural recovery of metals and PCBs. Continued exposure to contamination to human and ecological receptors.	No
In Situ Capping	Reduces risk by placing a cap over the contaminated sediment through physical/chemical isolation or sediment stabilization.	Re-exposure may occur because of potential cap disruption. Water depth of Eighteenmile Creek may not be adequate to support the cap materials.	No
In Situ Treatment	Involves biological, chemical, or physical treatment of contaminated sediment in place.	Technology is under early stages of development, and examples of proven success for commercial application have not been developed.	No
Removal Technologies			
Excavation/Dredging	Removes contaminated sediment when it is submerged (dredging) or dewatered (excavation).	Both are widely used and effective in the long-term.	Yes
Sediment Dewatering	Decreases the water content of the excavated sediment for disposal. Staging area needed.	Necessary for sediments whether excavated or dredged due to moisture content constraints at disposal facilties.	Yes
Sediment Treatment	Generally classified as biological, chemical, extraction/washing, immobilization, thermal, and particle size separation.	Pretreatment may be cost effective prior to disposal based on site conditions.	Yes
Sediment Disposal	Offsite disposal of the excavated and dewatered sediment to a landfill.	An effective means of managing excavated contaminated sediments.	Yes

Key:

IC = Institutional control.
FS = Feasibility study.
NCP = National Contingency Plan.
OU = Operable Unit
PCB = Polychlorinated biphenyl.

2.3.3.2 Institutional Controls

ICs generally refer to non-engineering measures intended to affect human activities in such a way as to prevent or reduce exposure to hazardous substances, often by limiting land or resource use. ICs can be used at all stages of the remedial process to reduce exposure to contamination. The most common types of ICs at contaminated sediment sites include fish consumption advisories and commercial fishing bans, waterway use restrictions, and land use restriction/structure maintenance agreements (EPA 2005).

ICs are usually accompanied by long-term monitoring (LTM) to demonstrate whether contamination levels exceed cleanup objectives. LTM of sediment will be recommended to evaluate site contaminant levels and determine if public and ecological threats increase or decrease.

ICs at this site can be implemented; however, they are not preferred because ICs would be difficult to implement and rely on for protection of human health with residents and active commercial/industrial facilities residing on properties along the creek. Although ICs are not applicable as a stand alone alternative, they will be retained for further consideration in conjunction with other remedial actions.

2.3.3.3 Monitored Natural Recovery

MNR is a remedy that uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. MNR usually involves acquisition of information over time to confirm that these risk-reduction processes are occurring. Naturally occurring processes for MNR may include physical (sedimentation, advection, diffusion, dilution, dispersion, bioturbation, and volatilization), biological (biodegradation, biotransformation, phyto-remediation, biological stabilization), and chemical (oxidation/reduction, sorption, or other processes resulting in stabilization or reduced bioavailability) mechanisms that act together to reduce the risk posed by the contaminants (EPA 2005).

Toxicity reduction through transformation or bioavailability reduction through increased sorption is the preferable means of MNR because the destructive/sorptive mechanisms generally have a higher degree of permanence. Dispersion is the least preferable means of MNR because dispersion may reduce risk in the source area yet increase the risks to downstream areas or other waterbodies.

Advantages of MNR include low implementation cost, non-invasive nature to the existing biological community, and less disruption to communities compared with dredging or in situ capping. However, MNR leaves contaminants in place and the risk reduction process could be slow. Therefore, the potential effects of re-exposure may be great.

- **Effectiveness.** MNR is most effective for contaminants susceptible to naturally occurring processes. MNR does not actively remediate contamination; therefore, contaminant level reduction may occur over a long period of time.

- **Implementability.** MNR is readily implementable.

- **Cost.** Compared to other sediment remedial technologies, the cost to implement MNR is low.

Since PCBs and metals in sediment are not readily degradable, there are hazardous level concentrations of PCBs and metals in sediments (maximum lead concentration is 25,400 ppm; maximum PCB concentration is 1,400 ppm) and there is a continuous risk to humans and ecological receptors; MNR will not be further considered.

2.3.3.4 In Situ Capping

In situ capping is a remedy that involves placing a subaqueous covering or cap of clean material over contaminated sediment. Capping materials are generally granular, such as clean sediment, sand, or gravel. More complex cap designs may include multi-layer material with geotextiles, liners, and other permeable/impermeable elements (EPA 2005).

A cap is designed to reduce risk through physical/chemical isolation, or sediment stabilization. In situ capping could be either applied independently or combined with other remedial technologies, i.e. installation of a cap after partial removal of contaminated sediment.

Various placement methods have been used for capping projects. Usually, controlled/accurate placement approaches need to be used to avoid displacement of or mixing with the underlying contaminated sediment with the capping material, and the resuspension of contaminated material into the water column. Applying materials slowly and uniformly can minimize the amount of sediment disruption and resuspension. Conventional mechanical methods rely on gravitational settling of cap materials. Wet granular materials could be discharged into the water column by pipe. Armor layer materials can be placed from barges or from shoreline using traditional equipment, such as clamshells. Sediment resuspension and contaminant release monitoring are usually part of the design of in situ capping projects (EPA 2005).

Advantages of in situ capping include (1) quick reduction of exposure to contaminants; (2) less expense because less infrastructure is required when compared with dredging/excavation; (3) lower chance of contaminant resuspension, dispersion, and volatilization during construction compared with dredging/excavation; (4) less disruption of local communities than dredging/excavation, which involves sediment dewatering, treatment, and transportation.

However, with in situ capping, sediment contamination will remain on site, which can be a potential threat to human health and the aquatic environment if the cap is disturbed. In some cases, the biological community may be altered since the capping material may not provide a preferred habitat. Capping is more effective in deeper waters (deeper than in Eighteenmile Creek) where hydrodynamic conditions such as floods and ice scour will not affect the cap.

- **Effectiveness.** In situ capping is most effective in waterbodies with a large water depth. Waterbodies with shallow water depths are more susceptible to damaging the cap by floods or ice scour.

- **Implementability.** Capping is readily implementable using standard equipment and materials.

- **Cost.** In situ capping costs are moderate compared to other sediment remedial technologies. The majority of the costs are for the capping material and its placement.

In situ capping does not appear to be the most effective means of addressing sediment contamination in Eighteenmile Creek primarily because the depth of the creek is shallow, generally several feet or less, and is not adequate (depth in the West Branch was typically 0.5 to 2 feet, while depth in the East Branch was approximately 3 to 4 feet based on measurements collected during the SRI). With a shallow water depth, there is a high potential that hydrodynamic conditions would compromise the integrity of the cap. In addition, Eighteenmile Creek, a Class D stream, is used for fishing and recreation; therefore, there is a high potential that humans may compromise the integrity of the cap. In situ capping will not be further considered.

2.3.3.5 In Situ Treatment

In situ treatment can involve biological (enhancement of microbial degradation of contaminants by the addition of materials such as oxygen, nitrate, or microorganisms into the sediment), chemical (destruction of contaminants through oxidation and dechlorination processes by providing chemical reagents), or physical (solidification, stabilization, or sequestering of contaminants through additives such as coal, coke breeze, and limestone) treatment of contaminated sediment in place. In situ treatment technologies could be used with other remedial approaches, such as in situ capping (EPA 2005).

In situ treatment is in the early stages of development by researchers, and few methods are commercially available. Several EPA Superfund Innovative Technology Evaluation (SITE) bench and field studies are underway. However, most of them are focused on the treatment of PCBs and PAHs. Studies to address metal-contaminated sediments have not been performed.

- **Effectiveness.** It is unclear as to the effectiveness of in situ treatment for contaminated sediments. Several studies are underway that focus on PCB and PAH-contaminated sediments. The effectiveness of the treatment depends on contact of the treatment matrix with the contaminated sediments.

- **Implementability.** The implementability of this technology is moderate. Equipment and materials to implement this technology are readily available, however, ensuring contact of the treatment matrix with the contaminated sediments may be difficult.

- **Cost.** Costs for in situ treatment are moderate. The majority of the costs associated with this technology is the treatment matrix and its delivery to the contaminated sediments.

In situ treatment technologies will not be considered further primarily because in situ treatment technologies are not a proven technology, nor has the technology proven to be effective in remediating metal-contaminated sediment. Additionally, implementing this technology may be difficult because of issues with the treatment matrix completely contacting the contaminated material in situ.

2.3.3.6 Removal Technologies

2.3.3.6.1 Excavation/Dredging

The two most common contaminated-sediment removal technologies are excavation and dredging. Dredging is defined as sediment removal while the sediment is submerged, whereas excavation is sediment removal after water has been diverted or drained. Major components of excavation/dredging may include sediment removal, transportation, staging, treatment (including water treatment), and disposal (EPA 2005).

Compared with remedies that leave the contaminated sediment in place (i.e., in situ capping), excavation/dredging removes the contaminated sediment and eliminates the potential for future exposure and transport of contaminated sediment more effectively. With respect to long-term effectiveness, excavation/dredging has fewer uncertainties than naturally occurring processes, such as MNR. The flexibility of future use of the water body resulting from excavation/dredging is another advantage of this technology over in situ cleanup methods, which typically require implementation of ICs that can ultimately limit water body use.

Because of the complex implementation of the excavation or dredging, the costs of these technologies are usually higher than MNR or in situ capping. Accommodation of equipment maneuverability and portability/site access could make the methods more complex and costly as well. Treatment technologies for excavated/dredged sediment may be challenging and disposal facilities may not be available.

Through excavation/dredging, contamination may not be removed completely and residuals may be left in place, especially for dredging. The amount of residual contaminants remaining on site could be the result of various factors, including equipment, operator experience, management practices, site conditions, etc.

Contaminant loss resulting from sediment resuspension during the construction process is another disadvantage of dredging. This concern would be much less for excavation (in the dry). A temporary destruction of the aquatic community and habitat within the remediation area may also be caused by excavation or dredging similar to in situ capping.

Excavation, where feasible, usually has advantages over dredging for the following reasons:

- Contamination removal is more complete;
- Potential for contaminant resuspension is less when the excavation area has been dewatered;
- Excavation equipment operators and oversight personnel can see the removal operations more easily when compared with dredging because the water has been drained or diverted; and
- Bottom conditions and sediment characteristics require much less consideration.

The excavation area can be isolated by using sheet piling, earthen dams, cofferdams, geotubes, temporarily diverting the waterbody, or permanently relocating the waterbody. Conventional earthmoving equipment, such as backhoes or draglines, is normally used for sediment removal after the dewatering process.

- **Effectiveness.** Excavation/dredging is effective in reducing risks to humans and ecological receptors by removing the contaminated sediments. This is a proven technology.
- **Implementability.** This technology is readily implementable using conventional construction equipment.
- **Cost.** The costs to implement excavation/dredging is relatively high compared to other sediment remedial technologies.

This technology is widely used and proven to be effective in the long-term in reducing risks to human and ecological receptors through removal of contaminated sediments. Therefore, excavation/dredging will be retained for further consideration.

2.3.3.6.2 Sediment Dewatering

Sediment excavation/dredging is normally followed by the transport of the sediment to a staging or rehandling area for dewatering. Transport could be done by using waterborne or overland methods including pipeline, barge, conveyor, railcar, or truck/trailer depending on-site conditions.

There are several methods of sediment dewatering. Conventional methods include sedimentation ponds and dewatering pits; more innovative solutions include geotextile dewatering bags and filter boxes.

Since excavation/dredging will be further considered as a remedial technology, sediment dewatering will also be considered as it is typically the next step after excavation/dredging but prior to disposal.

2.3.3.6.3 Sediment Treatment

Based on the type of contamination present in sediments, various treatment technologies can be implemented either as pretreatment or treatment as a primary method for contaminant elimination. Treatment of contaminated sediment is not usually a single process but often involves a combination of processes or a treatment train to address various contaminant problems including pretreatment, operational treatment, and/or effluent treatment/residual handling.

Pretreatment modifies the dredged or excavated material in preparation for final treatment or disposal. Most treatment technologies require that the sediment be relatively homogeneous and that physical characteristics be within a relatively narrow range. Pretreatment technologies may be used to modify the physical characteristics of the sediment to meet these requirements.

Depending on the contaminants, their concentrations, and the composition of the sediment, treatment to reduce toxicity, mobility, or volume of the contaminants before disposal may be warranted. Sediment treatment technologies are generally classified as biological, chemical, extraction or washing, immobilization (solidification/stabilization), and thermal (destruction or desorption). In some cases, particle size separation is also considered a treatment technology.

Since excavation/dredging has been considered, sediment pretreatment will also be further considered. The most likely form of treatment that is applicable at the Eighteenmile Creek Corridor Site is particle size separation because the majority of contamination was detected in sediments comprising fine-sized particles. COCs at the site (PCBs and metals) typically bind to fine-sized particles so particle size separation may help to reduce disposal costs.

2.3.3.6.4 Sediment Disposal

Disposal is the last step of contaminated sediment removal, and it is usually the major cost of any excavation design. Three sediment disposal facility options exist:

- **Upland Sanitary/Hazardous Waste Landfills.** The most widely used option. Most sediment should be dewatered or stabilized before disposal in this type of landfill.

- **Confined Disposal Facilities (CDFs).** CDFs are engineered dike structures designed to contain sediment. CDFs are widely used for larger navigational dredging projects, but they are not as common for smaller environmental dredging sites such as OU-1 at the Site. A CDF owned and operated by the United States Army Corps of Engineers (USACE) is located close to the site in Buffalo, New York.

- **Contained Aquatic Disposal (CAD).** CAD involves a subaqueous capping method in which the dredged sediment is placed in a natural or excavated depression elsewhere in the water body. CAD is commonly used for navigational dredging, but it is rarely used for environmental dredging. In situ capping was not further considered for this site; therefore, a CAD would not be applicable at this site.

Since excavation/dredging has been considered, sediment disposal in an upland sanitary/hazardous waste landfill will also be further considered because it is typically the last step in the excavation/dredging process.

Although a CDF is located near the site, for purposes of this FS, it was assumed that disposal of sediments at this facility is not a viable option due to the unknowns associated with the disposal requirements.

2.4 Identification of Alternatives

Remedial alternatives were developed by assembling GRAs chosen to represent the various technology types and media into combinations that address the site comprehensively. Three alternatives were developed for the site. These alternatives are described in the following subsections. Descriptions of each alternative have been developed according to the parameters set forth in NYSDEC's DER-10, Technical Guidance for Site Investigation and Remediation, Section 4.2.5. The following section provides a summary of the selected alternatives. Detailed analysis of these alternatives follows in Section 2.5.

2.4.1 Alternative 1: No Action

The No Action Alternative was carried through the FS for comparison purposes as required by the NCP. This alternative would be acceptable only if it is demonstrated that the contamination at the site is below the RAOs or that natural processes will reduce the contamination to acceptable levels. This alternative does not include ICs.

2.4.2 Alternative 2: Complete Removal of Contaminated Sediment to Pre-Disposal Conditions, Off-site Disposal, Bank Stabilization, and Continued Monitoring

This alternative consists of complete removal of sediments in Eighteenmile Creek and the millrace. Removed sediments will be dewatered and disposed off site in an approved disposal facility. Bank stabilization measures will be constructed to prevent erosion and future recontamination by upland soils. Monitoring will be periodically performed to measure and review whether RAOs are being achieved.

2.5 Detailed Analysis of Alternatives

This section provides an expanded description of each alternative along with an evaluation of each alternative against the eight criteria identified in NYSDEC's DER-10, Technical Guidance for Site Investigation and Remediation. The nine criteria include:

- **Overall Protection of Human Health and the Environment.** This criterion provides an overall check on whether the alternative protects human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria, especially long-term effectiveness, short-term effectiveness, and compliance with SCGs.

- **Compliance with SCGs.** This criterion evaluates compliance with SCGs that apply to this site. Standards are promulgated levels that apply directly to the media of interest and are required to be met. Criteria and guidance levels are non-promulgated levels that may be applicable and are TBC. Attainment of criteria and guidance is not legally required.

  SCGs include chemical-specific values that address concentrations of contaminants in various media; action-specific requirements, such as requirements for handling hazardous waste, and location-specific requirements, such as wetlands regulations.

- **Short-term Impacts and Effectiveness.** This criterion assesses the effects of the alternative during the construction and implementation phase until remedial objectives are met, including protection of the community during the action and the time required to complete the response.

- **Long-term Effectiveness and Permanence.** This criterion evaluates the permanence of the remedial alternative, the magnitude of the remaining risk, and the adequacy and reliability of the controls on any remaining contamination.

- **Reduction of Toxicity, Mobility, or Volume with Treatment.** This criterion addresses NYSDEC's preference for selecting "remedial technologies that permanently and significantly reduce the toxicity, mobility, and volume" of the COCs at the site. This evaluation consists of assessing the extent to which the treatment technology destroys toxic contaminants, reduces mobility of the contaminants using irreversible treatment processes, and/or reduces the total volume of contaminated media.

- **Implementability.** This criterion assesses the technical and administrative feasibility of implementing an alternative and the availability of various services required for the alternative's implementation.

- **Cost.** The estimated capital costs, long-term O&M costs, and environmental monitoring costs are evaluated. The estimates included herein (unless otherwise noted) assume engineering and administrative costs would equal 10% of the capital costs and contingency costs would equal 25% of the capital costs. A present-worth analysis is made to compare the remedial alternatives on the basis of a single dollar amount for the base year. For the present-worth analysis, assumptions are made regarding the interest rate applicable to borrowed funds and the average inflation rate. Based on *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008, an annual discount rate of 2.7% was assumed for this analysis. Also, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* states that, in general, the period of performance for costing purposes should not exceed 30 years for this analysis. Therefore, the following detailed analysis of remedial alternatives will follow this guidance. The comparative cost estimates are intended to reflect actual costs with an accuracy of +50% to –30%.

- **State Acceptance.** This assessment evaluates the technical and administrative issues and concerns the state may have regarding each alternative. This criterion will be addressed in the ROD once comments are received on the proposed plan. Therefore, no further discussion of this topic will be included in each alternative evaluation.

- **Community Acceptance.** Community acceptance will be addressed during the PRAP public comment period prior to formalization of the ROD. Therefore, no further discussion of this topic will be included in each alternative evaluation.

2.5.1 Alternative 1 – No Action

2.5.1.1 Description

The No Action Alternative is presented as a baseline for comparison with other alternatives. This alternative does not include remedial action, institutional, or engineering controls.

2.5.1.2 Analysis

Overall Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment because sediment contamination exceeding target risk levels and regulatory levels will continue to exist at the site. Contaminated sediments would continue to pose risks to current and future site users as well as ecological receptors.

Compliance with SCGs

Implementing a No Action Alternative would result in the contamination maintaining its current concentrations and impacts. Contaminant concentrations are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site.

Long-term Effectiveness and Permanence

This alternative would not be effective in the long-term because this alternative does not involve removal or treatment of contaminated material. Risks at the site would remain as they are currently.

Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative does not involve the removal or treatment of contaminated material. Therefore, neither the toxicity, nor mobility, nor volume of contamination is expected to be reduced. Natural attenuation of contaminants is not expected to significantly reduce their concentrations over time because PCBs and metals do not degrade appreciably over time.

Short-term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative because no remedial activities are involved.

This alternative does not include source removal or treatment and would not meet any of the RAOs developed in Section 2.2.1 in a reasonable or predictable time-frame.

Implementability

There would be no technical obstacles to implementing this alternative.

Cost

There would be no costs associated with this alternative.

2.5.2 Alternative 2 – Contaminated Sediment Excavation to Pre-Disposal Conditions, Off-site Disposal, Bank Stabilization, and Continued Monitoring

2.5.2.1 Description

This alternative involves the removal of contaminated sediment to the selected cleanup levels presented in Table 2-3. Figure 2-2 illustrates the areas of contamination to be addressed under this alternative, along with other operational features required to implement this alternative.

For purposes of this FS, it is assumed that a sediment release from pulling the canal plug could be avoided through operational changes (i.e., use of pumps) to prevent such a potential slug release to the creek. Additionally, CSOs are being monitored under NYSDEC Division of Water, and it is therefore assumed that the sediment levels in the sewer system are being monitored for the COCs for Eighteenmile Creek.

The logistics and access to Eighteenmile Creek and the millrace to implement this alternative would require special consideration due to portions of the creekbed consisting of bedrock, the wide range of flows/velocities, the adjacent land uses/types (e.g., heavily vegetated, steep slopes), and other factors. This FS presents a way in which this alternative can be implemented; however, during the remedial design phase, the approach may be modified to ease implementation as long as the ultimate goal of the alternative is achieved.

Phasing of work for this site must be coordinated with remedial efforts for the terrestrial upland properties (OU-2: Former Flintkote Plant site; OU-3: Former United Paperboard Company property; OU-4: Upson Park property; OU-5: White Transportation property; and OU-6: Water Street Residential Properties). As adjacent soils from the upland properties are a continuous source of contamination to the creek via erosion, remediation of the soils on these properties should be performed first or concurrent with OU-1 remediation. For purposes of this FS, the physical delineation between sediment and soils is defined by the bankfull elevation of the creek. This elevation was delineated by GPS during additional field investigations conducted by EEEPC in late 2008.

Erosion of soils from the upland properties is a continuous potential source of contamination to the creek as soil cleanup goals are generally higher than sediment cleanup goals. Therefore, bank stabilization has been included in each of the remedial alternatives for OU-1 as well as in all of the alternatives for the upland terrestrial properties, including OU-3, OU-4, OU-5, and OU-6.

Creek sediments can be removed either by excavation (in the dry) or dredging (in the wet). Due to the continuous flow to the creek from the Barge Canal based on downstream needs, flows in the creek will need to be managed properly during sediment removal.

Access to the creek is limited by commercial and residential property lining the majority of the creek to be remediated, steep slopes, and heavily vegetated banks. It is assumed that the staging area constructed at the White Transportation property for remediation of the upland terrestrial properties would be subsequently used during remediation of the creek sediments. For costing purposes, it was also assumed that an additional staging area would be constructed in the northern section of the Corridor Site to facilitate sediment excavation. Figure 2-2 shows the approximate location of the staging areas. Portions of these staging areas would be converted into sediment dewatering pits to allow sediments to be prepared for disposal.

Similarly, access roads constructed during remediation of the terrestrial properties would also be used during remediation efforts for OU-1. Two additional access roads (access roads 5 and 6) would likely need to be constructed north of the Water Street Residential Properties and Former Flintkote Plant in order to accommodate remediation of the downstream portion of the creek and the millrace. Proposed locations of staging areas and access roads are shown on Figure 2-2. For costing purposes, it was assumed that construction/deconstruction of the staging area and access roads needed for the upland terrestrial remedial efforts are included in the estimates for OU-3 through OU-6 (Section 3 of this report). Only the costs of the additional access roads, additional staging area, and the cost of

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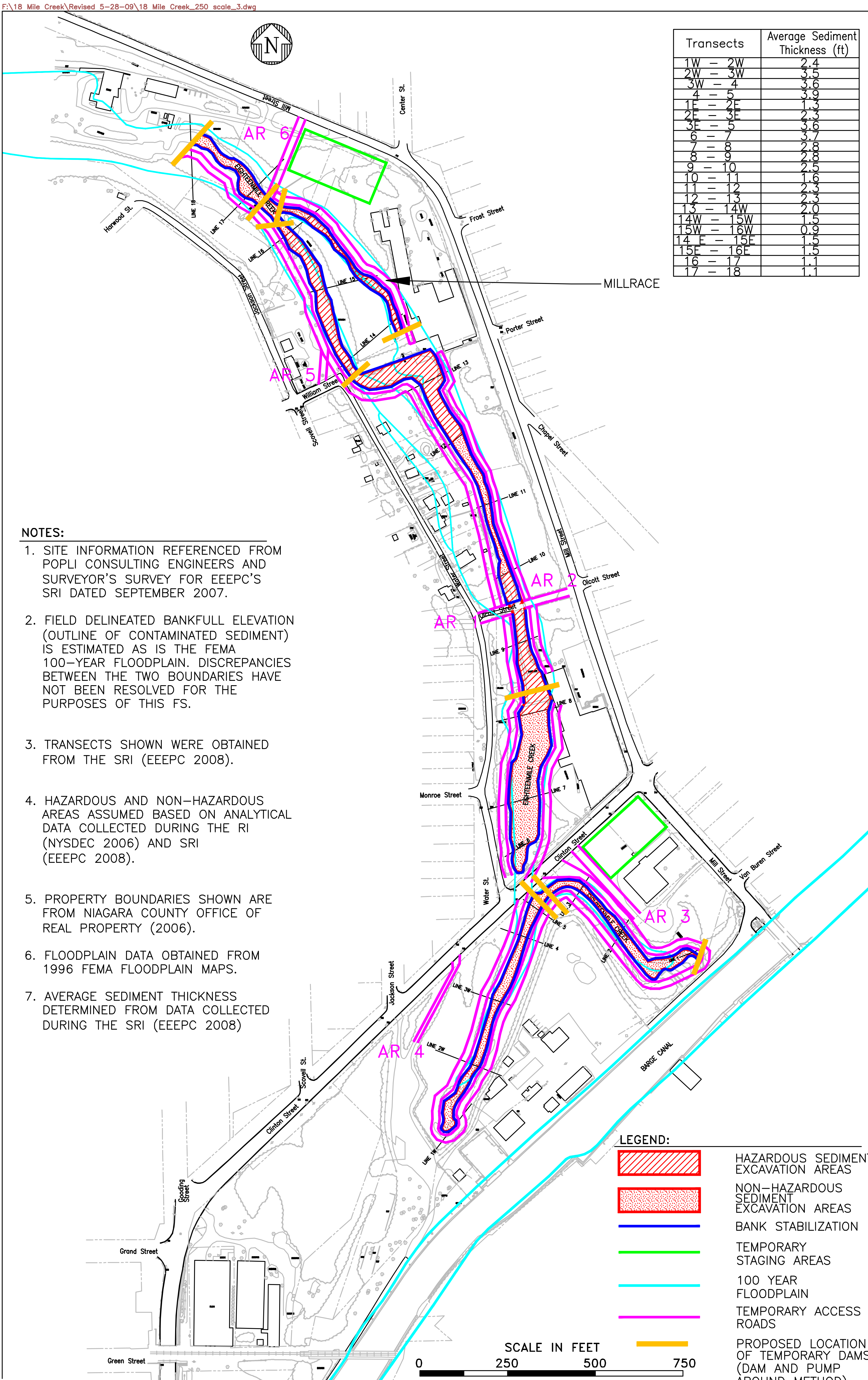


Transects	Average Sediment Thickness (ft)
1W – 2W	2.4
2W – 3W	3.5
3W – 4	3.6
4 – 5	3.9
1E – 2E	1.3
2E – 3E	2.3
3E – 5	3.6
6 – 7	3.7
7 – 8	2.8
8 – 9	2.8
9 – 10	2.5
10 – 11	1.6
11 – 12	2.3
12 – 13	2.3
13 – 14W	2.0
14W – 15W	1.5
15W – 16W	0.9
14 E – 15E	1.5
15E – 16E	1.5
16 – 17	1.1
17 – 18	1.1

NOTES:

1. SITE INFORMATION REFERENCED FROM POPLI CONSULTING ENGINEERS AND SURVEYOR'S SURVEY FOR EEEPC'S SRI DATED SEPTEMBER 2007.
2. FIELD DELINEATED BANKFULL ELEVATION (OUTLINE OF CONTAMINATED SEDIMENT) IS ESTIMATED AS IS THE FEMA 100-YEAR FLOODPLAIN. DISCREPANCIES BETWEEN THE TWO BOUNDARIES HAVE NOT BEEN RESOLVED FOR THE PURPOSES OF THIS FS.
3. TRANSECTS SHOWN WERE OBTAINED FROM THE SRI (EEEPC 2008).
4. HAZARDOUS AND NON-HAZARDOUS AREAS ASSUMED BASED ON ANALYTICAL DATA COLLECTED DURING THE RI (NYSDEC 2006) AND SRI (EEEPC 2008).
5. PROPERTY BOUNDARIES SHOWN ARE FROM NIAGARA COUNTY OFFICE OF REAL PROPERTY (2006).
6. FLOODPLAIN DATA OBTAINED FROM 1996 FEMA FLOODPLAIN MAPS.
7. AVERAGE SEDIMENT THICKNESS DETERMINED FROM DATA COLLECTED DURING THE SRI (EEEPC 2008)

ecology and environment

FIGURE 2-2: ALTERNATIVE 2 – COMPLETE EXCAVATION AND OFF-SITE DISPOSAL, BANK STABILIZATION
OU-1 EIGHTEENMILE CREEK AND MILLRACE
LOCKPORT, NEW YORK

constructing dewatering pits at both staging areas are included in the cost estimate for this alternative.

Since large equipment will be needed to dredge/excavate contaminated sediment, it was assumed that clearing and grubbing would be required along both sides of the creek for an approximate width of 20 feet. This would be in addition to the clearing and grubbing required for construction of access roads 5 and 6 as mentioned above.

Prior to sediment removal, the flows and sediment transport in the creek must be managed during construction. Although the means and methods will be prescribed during the design phase, the following two methods are presented for cost comparison purposes:

1. Installation of sand-filled dam bags within the creek to divert flow away from the working area but within the creek channel; and

2. Construction of temporary dam structures and diversion of water around dammed sections;

Comparisons between these two methods will be limited to short-term effectiveness, implementability, and cost. These two methods are expected to perform identically for the other evaluation criteria. Costs for these two methods will be presented separately in Tables 2-5A and 2-5B.

The first method involves installation of sand-filled dam bags that would divert water away from the working area. The use of dam bags is assumed to be more cost-effective and provides greater stability than the water-filled cylindrical portadam. Either method could be used; however, the dam bags were assumed for costing purposes. The dam bags would be configured in a semi-circle to divert the creek around but within the creek channel. Water behind the dam bags will be pumped out to allow for excavation under “near dry” conditions within the work area. As work progresses downstream, the dam bags can also be moved along the creek. For costing purposes, it is assumed that sediment will be removed from the dammed areas during low flow (based on an agreement with the Canal Corporation and the downstream power plant) or excavation in the wet and no additional flow management measures would be needed.

In conjunction with the installation of the dam bags, a turbidity curtain will be used to manage suspended sediments within the work area. Turbidity curtains are flexible screen barriers used to trap sediment in water bodies and are weighted at the bottom to achieve closure while supported at the top through a flotation system. Figure 2-3 illustrates how disturbed sediments are retained behind the curtain.

Source: EPA 2008

Figure 2-3 Turbidity Curtain Example

The second method of managing creek flows during remediation involves damming the creek in successive segments from upstream to downstream to allow excavation in the dry. Temporary dams would be constructed by stacking sand-filled bags to isolate segments of the creek for remediation. Dammed creek segments would then be pumped dry and upstream flow would be diverted around the segment to downstream portions of the creek. Due to limited space for construction of a diversion channel within the Eighteenmile Creek Corridor Site, water would be diverted around the excavation by a combination of continuously operating pumps and pipes.

For costing purposes, it was assumed that flows of approximately 250 cubic feet per second (cfs) would need to be diverted. This is based on flow measurements collected during the Additional Investigation (EEEPC 2009a). This flow rate is characteristic of conditions within the creek during the navigational season when flow in Eighteenmile Creek is augmented with flow from the Barge Canal. Although flow during the non-navigational season would be less, it was assumed for the purpose of this study that work would be conducted during the summer months (i.e. navigational season) to avoid problems typically encountered during winter construction, such as freezing of pipes and dewatering equipment.

Furthermore, although flow into Eighteenmile Creek can be limited by reducing the flow from the Barge Canal, downstream requirements of the power generating facility at Burt Dam limit this ability. Therefore, costing for this method conservatively assumes that construction would be performed under the operating flows measured during the Additional Investigation (EEEPC 2009a).

Additionally, the following construction sequence for damming and diverting flows is presented as an example of how this method could be implemented.

Bank protection and creek restoration would occur in the dry after sediment remediation.

1. First, both gates of the dry dock would be closed and sealed to prevent flow from entering the west branch of Eighteenmile Creek. A temporary dam would be constructed downstream at the confluence of the east and west branches near Clinton Street. The west branch would be pumped dry, sediments excavated, and the section restored.

2. After remediation of the west branch, a temporary dam would be constructed upstream of the east branch and water entering the creek from the Barge Canal would be pumped around this segment to downstream of the existing Clinton Street Dam. A second temporary dam would be constructed below the existing Clinton Street Dam. The east branch and Mill Pond would be pumped dry and sediments excavated. The Clinton Street Dam would be removed and the section restored. See "Creek Restoration" below.

3. Remediation of the next section would utilize the temporary dam constructed below the Clinton Street Dam and a second temporary dam to be constructed near William Street. Upstream flow would be diverted downstream of William Street. The channel would be pumped dry and sediments excavated and the section restored.

4. Remediation of the next section (millrace) would involve construction of temporary dams at the north and south ends of the millrace. Flow within the creek would continue on its present course around west side of the Flintkote island. The millrace would be pumped dry and sediments excavated and section restored.

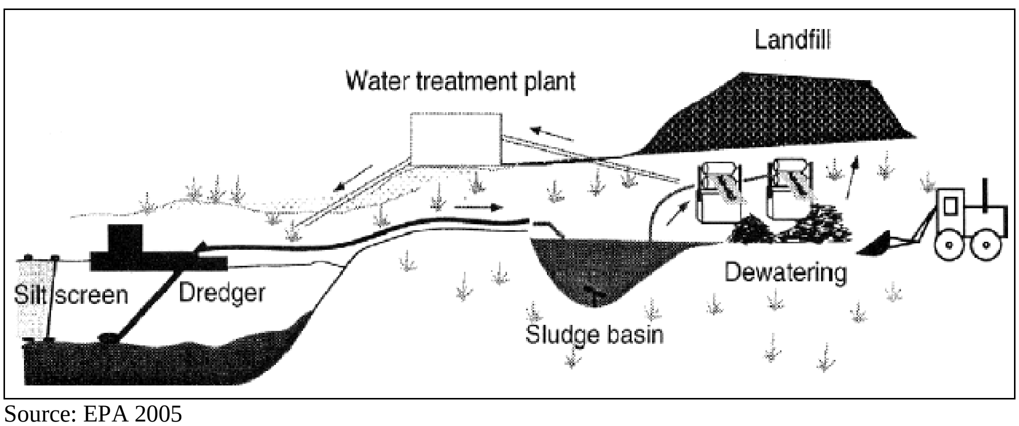
5. After remediation of the millrace, temporary dams would be constructed at William Street and on the creek just before the millrace rejoins the main channel. Flow would be diverted through the millrace. The main channel would be pumped dry, sediments excavated, and the section restored.

6. Finally, temporary dams would be constructed where the millrace and creek join and at the northern end of the Corridor Site, near Harwood Street. Flow would be diverted around this section, the creek pumped dry, sediments excavated, and the section restored.

Either of these methods for managing flows could be implemented. In either case, it is assumed that all creek sediments will be removed to bedrock/refusal because the creek is a dynamic system and contamination found in sampling during 2007/2008 may or may not be found at the same levels when this alternative is implemented.

Sediment thicknesses were averaged between transects defined in the SRI and are based on measurements collected during the sampling efforts. Sediment thicknesses ranged from 2 feet or less in the East Branch and the main channel and up to 4 feet in the West Branch. Average sediment thicknesses are shown on Figure 2-2. The lateral extent of sediment contamination is defined as the bankfull elevation and is also shown on Figure 2-2.

Material Handling: From the creek banks, an excavator will remove contaminated sediments in phases starting upstream and moving downstream. Mechanical dredging was selected as the method to remove contaminated sediments over hydraulic dredging primarily due to minimum water depth requirements. In review of EPA guidance (EPA 2005) and discussions with dredging contractors, hydraulic dredging equipment requires a minimum water depth of approximately 3 feet; the average water depth at the site was measured in November 2008 at 1 to 2 feet in the West Branch and 3 to 4 feet in the East Branch and main channel. In addition, it is anticipated that hydraulic equipment may clog because cobbles and larger-sized particles would be too heavy to be suctioned up through the equipment and could impede access to the smaller particles below (where the majority of contamination resides). Therefore, it is assumed that an excavator will be used to dredge the sediments. The excavator will place the dredged sediments into lined trucks for transport to a staging area for dewatering. Typically, sediments are dewatered as shown in Figure 2-4; however, other methods of dewatering sediment can be applied. For costing purposes, it was assumed that two dewatering pits will be constructed at the staging area and will include gravel and drainage piping under a covered enclosure. The pits will be designated to segregate suspected hazardous and non-hazardous sediments. The sediments would be placed over the gravel pit and allowed to dewater over time. Wastewater generated would need to be managed accordingly. For costing purposes, it was assumed the wastewater would be collected in a temporary storage tank and disposed off site at a local wastewater treatment plant (WWTP) or other applicable disposal facility.



Source: EPA 2005

Figure 2-4 Conventional Dredging Dewatering Operation

After the sediment is dewatered, it will be transported off site to a local landfill. Local landfill representatives indicated that they would require the dewatered sediment to pass the paint filter test before accepting sediments. Characterization sampling for PCBs and metals will need to be performed to determine whether the sediments will be disposed of as non-hazardous or hazardous material. Sampling conducted during the RI and SRI indicated the presence of hazardous sediments due to concentrations of PCBs greater than 50 ppm and failures of TCLP tests for lead. However, failures of TCLP tests for lead could not be correlated with high lead concentrations. Therefore, for costing purposes, the volume of sediments to be considered hazardous was estimated to be approximately 4,600 CY, based on locations where sampling indicated the presence of hazardous waste (see Figure 2-1). It is assumed that during remediation, sampling will be conducted on all sediment removed and hazardous and non-hazardous material will be segregated and disposed of properly.

To reduce the amount and cost of material to be disposed, the sediments may be screened prior to disposal because contaminants exceeding the cleanup objectives are expected to be contained mostly in finer particles. Larger-sized particles that are retained in the screen would need to be analyzed for metals and PCBs to confirm levels are below cleanup objectives but could then be placed back in the creek, thus diverting this material from disposal at a landfill. However, for costing purposes, this alternative conservatively assumes that all excavated sediment will be disposed offsite.

Creek Restoration: Reconstruction of the creek banks may impact the areas' floodplain and floodway. A floodplain study may be required. Additionally, as stated in its comment letter on the Draft Eighteenmile Creek Feasibility Study (NYSDEC, May 7, 2009), the NYSDEC has determined that the Clinton Street Dam must be removed for remediation purposes and replaced with hydraulic controls. A hydraulic study will be required to determine the types and locations of these control structures.

For costing purposes, it was assumed that these controls would consist of a series of low-head engineered rock riffles that would control flows within the creek and reduce erosion and scour of the banks. These controls would have crest heights of approximately 2 feet and sloped downstream for a length of 40 feet. Based on the height of the current Clinton Street Dam, it is assumed for costing purposes that 8 of these structures would be constructed at appropriate intervals throughout the main creek channel. Actual selection and design of appropriate hydraulic controls would be conducted following the hydraulic study, as part of the remedial design phase. Estimated costs for removal of the Clinton Street Dam and installation of hydraulic control features are included in Tables 2-5A and 2-5B.

As described earlier, bank stabilization will be conducted as part of sediment remediation and coordinated with remediation at the upland properties to limit erosion of soils from recontaminating the creek. Various types of erosion controls will be installed along the creek banks to dissipate the creek energy at bankfull flow as opposed to transferring the energy downstream. Erosion control measures can include combinations of non-structural measures (slope grading and revegetation), bioengineering (brush matting, tree root wads), biotechnical (erosion control mats, vegetated structures), and structural (riprap, boulder, weirs) features where applicable.

LTM will be performed at the site to monitor metals and PCB levels in site sediments and ensure that creek banks are stabilized. Since this alternative assumes removal of contaminated sediments site-wide, monitoring is assumed to be performed once every five years. If levels exceed cleanup objectives, contaminant levels, health risks, and the sampling plan will be re-evaluated accordingly. For costing purposes, it was assumed five sediment samples will be collected along the section of the creek remediated as part of this alternative. Additionally, bi-annual surveys will be performed to monitor the stabilization of the creek banks.

2.5.2.2 Analysis

Overall Protection of Human Health and Environment

This alternative is protective of human health and the environment since contaminated sediment will be removed from the site and properly disposed of in an environmentally acceptable facility. The contaminated sediment will essentially no longer present an exposure risk. Bank stabilization measures will help retain remaining upland soils in place, minimizing the risk of soil from eroding into the creek.

Compliance with SCGs

This alternative complies with SCGs since contaminated sediments will be removed from the site and properly disposed of in an environmentally acceptable facility. Off-site disposal will comply with all applicable land disposal restrictions and analytical requirements. Action- and location-specific SCGs including noise limitations, floodplain considerations, permits (as required), and Occupational Safety and Health Administration (OSHA) regulations will be complied with during implementation of this alternative.

To implement this alternative, permits or permit equivalencies will need to be obtained from the appropriate regulatory agencies, including the NYSDEC Division of Fish and Wildlife for potential impacts on ecological receptors, the NYSDEC Division of Water for wastewater discharge and stormwater, and the USACE for stream/wetland disturbance and dredging activities. In addition, access agreements with property owners will need to be obtained.

Long-term Effectiveness and Permanence

Removal and off-site disposal of the contaminated material is considered to be an adequate and effective remedy in the long-term since the contaminated sediment will no longer represent a human health or ecological risk. Furthermore, OU-1 will no longer be a source of contamination to downstream sections of the creek.

Through bank stabilization, soil on the banks with contaminant levels greater than those for sediments will be retained on the creek banks to the maximum extent practicable. Use of erosion control/stabilization measures that emphasize native materials/plantings will help to ensure long-term permanence through the restoration of the riparian habitat.

Reduction of Toxicity, Mobility, and Volume through Treatment

Excavation and off-site disposal of contaminated sediment will limit concerns associated with toxicity and mobility of the contaminants at the site. However, in discussions with disposal facility representatives, it is not anticipated that the material will be treated. Since the material will be disposed of in an engineered-permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Short-term Impacts and Effectiveness

Several short-term impacts on the community and workers may arise during excavation of contaminated media at the site. These include dust, noise, and potential spills during handling and transportation of contaminants. Access agreements with property owners would be required to perform this work not only to access the creek but also to provide staging areas for material storage and handling. To minimize short-term impacts, site access will be restricted during construction and remediation activities. Health and safety measures, including air monitoring, use of appropriate personal protective equipment (PPE), and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded.

Off-site transportation of contaminated sediment to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be minimized by using closed and lined containers for transport.

Because this alternative involves removal of the contaminated sediments from the site, site RAOs will be achieved at the completion of this work. The time required to complete the construction phase of this alternative is estimated to be 2 years, assuming 6 month construction seasons. LTM would continue for an assumed 30 years.

Both methods presented in this report for managing creek flows would be effective in the short term as both methods would allow excavation of sediment under "near dry conditions."

Implementability

The implementability of this alternative is moderate. While the construction methods are relatively standard, implementation of remedial site actions is complicated by limited site access, steep slopes, creek bed type, and on-site sediment dewatering methods. Engineering consultants and contractors are readily available to design and complete such an alternative. Disposal would be coordinated with an appropriate disposal facility.

Both methods for managing creek flows could be readily implemented using standard construction equipment and materials. However, each method would also have challenges associated with implementation. Placement and configuration of sand bags for in-channel diversion would be complicated by narrow creek widths in several locations. Additionally, diversion by damming and pumping would require continuous operation of several large capacity pumps to accommodate high flows in the Eighteenmile Creek Corridor.

Cost

Total present-worth costs of this alternative based on a 30-year period are $8,779,000 for in-channel diversion and $13,383,000 for damming and pumping (see Table 2-6). Tables 2-5A and 2-5B present the quantities, unit costs, and subtotal costs for the various items in this alternative. Contractor quotes were considered for some of the sediment removal costs, while other cost estimating information was obtained from 2008 RS Means Cost Data series and engineering judgment.

As mentioned earlier, costs for the staging area at the White Transportation Property and most access roads (access roads 1 through 4, and along the creek) are included in cost estimates for remediation of the individual upland properties and are, therefore, not included in this estimate. It is assumed that remediation of the creek will be performed in cooperation with and subsequent to the terrestrial properties.

Table 2-6 presents a summary of each alternative duration and total present-worth cost for comparison purposes.

2.6 Comparative Analysis of Alternatives

This section presents a comparative analysis of remedial alternatives. The alternatives for each specific media were based on the seven evaluation criteria, and this comparative analysis is based on the evaluations provided in Section 2.5.

Overall Protection of Human Health and the Environment

Alternative 2 is protective of human health and the environment because all contaminated sediment found above cleanup objectives will be removed. Alternative 1 is not protective of human health and the environment.

Compliance with SCGs

Alternative 2 complies with SCGs because sediments above cleanup goals will be removed. Alternative 1 does not comply with SCGs.

Long-term Effectiveness and Permanence

Alternative 2 is effective in the long-term because all sediment contamination will be removed and the banks of the creek will be stabilized to facilitate future permanence by limiting erosion and recontamination by upland soils. Alternative 1 is not effective in the long-term.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 2 will reduce the toxicity and mobility of contaminated material on site through relocation of contaminated material to a permitted landfill. Contamination levels are not expected to be significantly reduced over time in Alternative 1.

Short-term Impacts and Effectiveness

There is the potential for some negative short-term impacts for Alternative 2 as a result of construction activities. Alternative 1 does not have short-term impacts since no remediation activities will take place.

Implementability

Alternative 2 can be readily implemented at the site. However, there may be some challenges due to the limited availability of space at the site and steep slopes along the banks. There are no actions to implement for Alternative 1.

Cost

Alternative 2 will actively remediate the site at a cost of $8,779,000 or $13,383,000, depending on the method used to manage flows within the creek (see Table 2-6). Alternative 1 calls for no action, and thus incurs no costs.

Table 2-5A Cost Estimate, Alternative 2a - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; In-Channel Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Site Preparation					
Mobilization/Demobilization	Includes mobilizing equipment and personnel; assume trailers, site prep, staging, and access roads included in upland terrestrial OUs	1	LS	$200,000	$200,000
Health and Safety Requirements	Officer; assume on-site 100% of project duration	260	Day	$800	$208,000
Permits and Studies	Incl permits and hydraulic and floodplain study	1	LS	$100,000	$100,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume total of 20 days for pre-, during, and after construction surveys	20	Day	$1,600	$32,000
Traffic Control (Labor)	For roads adjacent to the site, including Clinton St, Water St, and Mill St; assume 50% of project duration	130	Day	$600	$78,000
Clinton Street Dam Removal					
Dam Demolition	Assume dam is a reinforced concrete structure	100	LF	$795	$79,500
Transport to Disposal Facility (Non-Haz)	Assume disposal 28 tons/load to Chaffee Landfill, Chaffee, NY; add 50% to material for unknowns (dam thickness, internal material, foundation, etc.)	2524	Ton	$13.00	$32,900
Disposal at Disposal Facility (Non-Haz)		2524	Ton	$26.00	$65,700
Site Clearing					
Cut and chip heavy trees	For Access Roads 5 and 6 and Along Creek Banks	3.8	Acre	$12,300	$47,100
Grub stumps and remove - heavy	For Access Roads 5 and 6 and Along Creek Banks	3.8	Acre	$6,525	$25,000
Construction of Access Roads, (Access Roads 5 and 6 and Along Creek Banks), Staging Area #2 and Sediment Dewatering Pits					
(Staging Area #1 and Access roads (1 - 4) costed in Section 3 cost estimates as part of the upland terrestrial properties are not duplicated here)					
Access Road Grading		18,500	SY	$1.40	$25,900
Access Road Construction					
Geofabric		18,500	SY	$2.58	$47,800
Gravel	8" gravel fill; incl labor + materials	18,500	SY	$14.75	$272,900
Staging Area Construction	8" gravel fill and liner, incl. labor + materials	3,472	SY	$14.75	$51,215
Sediment Dewatering Pits					
Covered Enclosure - Delivery and Installation	Assume approx 150' x 50'	4	EA	$22,000	$88,000
Covered Enclosure - Rental	Assumes 2 enclosures to remain onsite during and between construction seasons	36	Mo	$3,750	$135,000
Excavation	1 CY bucket	1111	BCY	$14.65	$16,300
Liner	add 10% to quantity to account for anchoring and overlapping	14,300	SF	$2.64	$37,800
Drainage Piping	4" dia drainage piping	400	LF	$3.01	$1,300
Stone Bedding		185	BCY	$44.50	$8,300
Filter Fabric		14,300	SF	$1.91	$27,400
Sump/Manhole	6' deep manhole	4	EA	$1,550	$6,200
Pump	50 gallons per minute	4	EA	$1,400	$5,600
Wastewater Storage Tank	Rental of 21,000 gal tank	36	Mo	$1,900	$68,400
Wastewater Disposal	Assume disposal at local WWTP	1,100	kGal	$3.00	$3,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	260	Day	$729.84	$189,800
Sediment Removal					
Creek Diversion	Assumes the use of 4' x 4' x 4' fabric dam bags, for each 200' length of creek, for half the width of the creek; Need to stack bags in areas where creek depth is greater than 4'	40	EA	$10,000	$400,000
Turbidity Curtain		8,000	LF	$15.00	$120,000
Sediment Excavation	Assume use of excavator with clamshell bucket; 1 CY bucket	14,500	BCY	$14.65	$212,500
Material Transportation On-site (from creek to staging areas)		16,240	LCY	$3.73	$60,600
Paint Filter Test		23	EA	$50.00	$1,200
Disposal Sampling	PCBs and TCLP metals analysis; 1 day turnaround	23	EA	$320	$7,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	14,250	Ton	$13.00	$185,300
Disposal at Disposal Facility (Non-haz)	assume non-hazardous material	14,250	Ton	$26.00	$370,500
Transport to Disposal Facility (Haz)	assumes transport of material to Model City, NY	7,500	Ton	$25.00	$187,500
Disposal at Disposal Facility (Haz)	disposal of hazardous material	7,500	Ton	$165	$1,237,500
Removal of Access Roads, Staging Area #2, and Dewatering Pits					
Excavate Gravel	1 CY bucket	5,068	BCY	$14.65	$74,300
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	7,463	Ton	$13.00	$97,100
Disposal at Disposal Facility (Non-haz)	assume non-hazardous material	7,463	Ton	$26.00	$194,100
Transport to Disposal Facility (Haz)	assumes transport of material to Model City, NY; assume half of the gravel in the sediment pits will need to be disposed of as hazardous	139	Ton	$25.00	$3,500
Disposal at Disposal Facility (Haz)	disposal of hazardous material	139	Ton	$165	$23,000
Restoration of Access Roads (Access Roads 5 and 6) and Staging Area #2					
Topsoil (Material)	For access roads; assume 8" of material	1,072	LCY	$16.25	$17,500
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,072	LCY	$24.00	$25,800
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	1,072	LCY	$1.85	$2,000
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	932	ECY	$2.82	$2,700
Finish grading, large areas		4,194	SY	$0.72	$3,100
Hydroseeding large areas		4,194	SY	$0.39	$1,700
Restoration of Access Roads Along Creek Banks and Dewatering Pits	To be performed in conjunction with bank stabilization on the adjacent upland properties; included in cost estimates for those OUs				
Bank Stabilization for Eighteenmile Creek (for entire length of creek, within the creekbed to the bankfull elevation. Costs for stabilization of soils upland of the bankfull elevation are included with the estimates for remediation of the adjacent propert					

Table 2-5A Cost Estimate, Alternative 2a - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; In-Channel Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
Synthetic geotextile	Geotextile fabric; Assume extends 10' horizontally into the creek from the bankfull elevation; includes anchoring	8,889	SY	$2.58	$23,000
Clean Stone	Small to medium sized stone for repair of banks and anchoring geotextile fabric.	2,556	LCY	$55.00	$140,600
Plantings	live stakings one per foot; along both banks	8,000	LF	$2.15	$17,200
Replacement Hydraulic Controls					
Engineered Rock Riffles	to control hydraulic gradient in place of Clinton Street Dam; assumed to have crest height of 24" and sloped downstream for 40 feet; assume 8 are needed				
Stone (Heavy)	DOT heavy sized	36	LCY	$96.56	$3,500
Stone (Light)	DOT light sized	356	LCY	$78.27	$27,900
Haul Material	12 CY dump truck, 20 miles round trip, 0.4 load/hr	391	LCY	$24.00	$9,400
Place / Spread Stone	Front end loader, 3 CY bucket	391	LCY	$9.10	$3,600
				Capital Cost Subtotal:	$5,330,915
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$5,282,937
				25% Legal, administrative, engineering fees, construction management:	$1,320,800
				25% Contingencies:	$1,651,000
				Capital Cost Total:	**$8,254,800**
				Capital Cost Total (2009 Dollars):	**$8,507,000**
Annual Costs					
Site Monitoring	Visual survey of creek banks, etc., assume 2-persons @ $100/hr; 10 hr/day for 1 day per each of 2 events	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$5,946
				10% Legal and Administrative fees:	$600
				25% Contingencies:	$1,700
				Annual Cost Total:	**$8,300**
				30-year Present Worth of Annual Costs:	**$169,200**
				30-year Present Worth of Annual Costs (2009 Dollars):	**$175,000**
Periodic Costs (Every 5 Years)					
Sediment Sampling	5 sediment samples; assume 5 locations/day, 2-persons @ $100/hr, 10hr/day	1	Events	$2,000	$2,000
Analytical Costs (PCBs and metals)	Samples from 10 sediment locations; standard turnaround	5	EA	$200	$1,000
Data Evaluation and Reporting		20	HR	$100	$2,000
Creek Bank Repair	Assume 5% of initial costs for bank stabilization	1	LS	$9,100	$9,100
				Periodic Cost Subtotal:	$14,100
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$13,973
				10% Legal and Administrative fees:	$1,400
				25% Contingencies:	$3,900
				Periodic Cost Total:	**$19,300**
				30-year Present Worth of Periodic Costs:	**$93,400**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$97,000**
				2009 Total Present Worth Cost:	**$8,779,000**

Notes:

1. For access roads, assume the 4 access roads constructed for remediation of upland soils on adjacent properties will be used. Additionally, 2 other access roads will be constructed downstream near the Former Flintkote Plant Property.

Length Access Road 5	125	ft	
Length Access Road 6	200	ft	
Access roads along both sides of creek	8000	ft	
Access road width (assumed):	20	ft	
TOTAL ACCESS ROAD AREA:	166,500	SF, or	18,500 SY

2. Assume access roads 5 and 6 will need clearing and grubbing; Assume access roads along creek will already be cleared and grubbed during remediation of upland terrestrial properties, with the exception of the area downstream of the Former Flintkote Prop

3. Assume the staging area constructed for remediation of the upland terrestrial properties will be used. Costs for this staging area are included in cost estimates for remediation of those properties.

4. Assume an additional staging area (Staging Area #2) will be constructed at the northern end of the site to facilitate sediment excavation.

Staging area is approx: 125 ft X 250 ft
31,250 SF, or 0.7 acres

4. Assume parts of both staging areas will be converted into sediment dewatering pits. Assume:
4 pits
100 ft length
25 ft wide
3 ft deep
6 in thick layer of stone

5. Total contaminated sediment volume:	14,500	BCY
Volume of hazardous sediment	5,000	BCY
Volume of non-hazardous sediment	9,500	BCY

6. Soil excavated for the sediment dewatering pits will be backfilled in its original location, thus eliminating the need to import fill material.

Table 2-5A Cost Estimate, Alternative 2a - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; In-Channel Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
7. Construction duration estimate (assumes standard 5-day work week):					
		2	construction seasons, 6 months each		
8. Length of Creek		4,000	ft		
9. Bank Dimensions					
;e Depth at Bankfull Elevation		3	feet		
Assumed Width from Bankfull Elevation to bottom of cree		5	feet		
Assume banks slope linearly from bankfull elevation to creek bed.					
10. Assumed average number of vertically stacked rows of dam bags to account for water depths greater than 4'		2			
11. Assume dam bags will be purchased for and reused and moved for the remaining length of creek		2,000	feet of creek		
12. Conversion from BCY to LCY (dewatered material):		1.15	LCY/BCY		
13. Conversion from BCY to tons (dewatered material):		1.5	tons/BCY		
14. Conversion from BCY to LCY (saturated material):		1.12	LCY/BCY		
15. Conversion from BCY to tons (saturated material):		1.7	tons/BCY		
16. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the					
17. Costs presented are based on conventional contracting methods.					
18. Assumed pore space for sediments (assume sand)		35	%		
19. Conversion from CY to gallons		202	gallons/ CY		
20. Unit costs obtained from 2008 RS Means Cost Data books. To adjust these unit costs to 2009, a historical cost index was applied.					
		2008	180.4		
		2009	185.9		
21. Assumed Dimensions/Properties for Clinton Street Dam (Based on Photos and Site Survey) for estimating purposes					
Width		100	feet		
Height		15	feet		
Thickness at Top		5	feet		
Thickness at Base		25	feet		
Material	Reinforced Concrete				
Assume trapezoidal dam cross section					
22. Engineered Riffle Assumptions					
Crest Height		2	feet		
Upstream Slope		25	%		
Downstream Slope		5	%		
Length of Riffle		40	feet		
Average Creek Width		30	feet		
Width of Riffle Toe		40	feet		
Typical Width of DOT Heavy Stone		2	feet		
Volume of Heavy Stone Required		36	CY		
Volume of Light Stone Required		356	CY		
Number of Riffles Needed		8			
23. Density of Concrete		2.0	tons/LCY		

Key:

BCY = Bank cubic yards.	Mo = Month.
CY = Cubic yards.	MSF = 1000 square feet.
EA = Each.	PCB = Polychlorinated biphenyl.
ECY = Embankment cubic yards.	SF = Square feet.
HR = Hour.	SY = Square yards.
kGal = Thousand gallons.	TCLP = Toxicity characteristic leaching procedure.
LCY = Loose cubic yards.	WWTP = Wastewater treatment plant.
LF = Linear feet.	
LS = Lump sum.	

Table 2-5B Cost Estimate, Alternative 2 - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; Dam and Pump Around Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Site Preparation					
Mobilization/Demobilization	Includes mobilizing equipment and personnel; assume trailers, site prep, staging, and access roads included in upland terrestrial OUs	1	LS	$200,000	$200,000
Health and Safety Requirements	Officer; assume on-site 100% of project duration	260	Day	$800	$208,000
Permits and Studies	Incl permits and hydraulic and floodplain study	1	LS	$100,000	$100,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume total of 20 days for pre-, during, and after construction surveys	20	Day	$1,600	$32,000
Traffic Control (Labor)	For roads adjacent to the site, including Clinton St, Water St, and Mill St; assume 50% of project duration	130	Day	$600	$78,000
Clinton Street Dam Removal					
Dam Demolition	Assume dam is a reinforced concrete structure	100	LF	$795	$79,500
Transport to Disposal Facility (Non-Haz)	Assume disposal 28 tons/load to Chaffee Landfill, Chaffee, NY; add 50% to material for unknowns (dam thickness, internal material, foundation, etc.)	2,524	Ton	$13.00	$32,900
Disposal at Disposal Facility (Non-Haz)		2,524	Ton	$26.00	$65,700
Site Clearing					
Cut and chip heavy trees	For Access Roads 5 and 6 and Along Creek Banks	3.8	Acre	$12,300	$47,100
Grub stumps and remove - heavy	For Access Roads 5 and 6 and Along Creek Banks	3.8	Acre	$6,525	$25,000
Construction of Access Roads, (Access Roads 5 and 6 and Along Creek Banks), Staging Area #2 and Sediment Dewatering Pits					
(Staging Area #1 and Access roads (1 - 4) costed in Section 3 cost estimates as part of the upland terrestrial properties are not duplicated here)					
Access Road Grading		18,500	SY	$1.40	$25,900
Access Road Construction					
Geofabric		18,500	SY	$2.58	$47,800
Gravel	8" gravel fill; incl labor + materials	18,500	SY	$14.75	$272,900
Staging Area Construction	8" gravel fill and liner, incl. labor + materials	3,472	SY	$14.75	$51,215
Sediment Dewatering Pits					
Covered Enclosure - Delivery and Installation	Assume approx 150' x 50'	4	EA	$22,000	$88,000
Covered Enclosure - Rental	Assumes 2 enclosures to remain onsite during and between construction seasons	36	Mo	$3,750	$135,000
Excavation	1 CY bucket	1111	BCY	$14.65	$16,300
Liner	add 10% to quantity to account for anchoring and overlapping	14,300	SF	$2.64	$37,800
Drainage Piping	4" dia drainage piping	400	LF	$3.01	$1,300
Stone Bedding		185	BCY	$44.50	$8,300
Filter Fabric		14,300	SF	$1.91	$27,400
Sump/Manhole	6' deep manhole	4	EA	$1,550	$6,200
Pump	50 gallons per minute	4	EA	$1,400	$5,600
Wastewater Storage Tank	Rental of 21,000 gal tank	36	Mo	$1,900	$68,400
Wastewater Disposal	Assume disposal at local WWTP	1,100	kGal	$3.00	$3,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	260	Day	$729.84	$189,800
Sediment Removal					
Creek Diversion	Method assumes damming the creek in 6 sections, pumping dry, and diverting water around dammed sections				
Temporary Dams	assume dam bags will be purchased for 2 temporary dams and relocated as necessary	2	EA	$5,000	$10,000
Dewatering Pumps	Pumps for dewatering dammed creek sections, 6" submersible pump, 400 gpm	3	EA	$7,000	$21,000
Rental of Diversion Pumps / Equipment	Costs are for monthly rental of (13) 8000 gpm pumpsets, including controls, valves, and influent piping	12	Mo	$197,000	$2,364,000
Transportation Costs	Delivery and pickup of diversion pumps / equipment	2	EA	$30,800	$61,600
Corrugated Plastic Pipes	60" diameter, to convey diverted water; assume 5 pipes are needed (based on flow to be diverted)	5,000	LF	$126	$630,000
Installation / Relocation	Assume 1 week to install / move dams, pumps, and equipment; assume 6 moves needed				
Labor and Equipment	Includes costs for an excavator, 2 laborers, an operator, and a foreman	6	EA	$13,000	$78,000
Pump Setup (By Vendor)	Includes costs to connect pipe and set up pumps	6	EA	$27,500	$165,000
Turbidity Curtain		8,000	LF	$15.00	$120,000
Sediment Excavation	Assume use of excavator with clamshell bucket; 1 CY bucket	14,500	BCY	$14.65	$212,500
Material Transportation On-site (from creek to staging areas)		16,240	LCY	$3.73	$60,600
Paint Filter Test		23	EA	$50.00	$1,200
Disposal Sampling	PCBs and TCLP metals analysis; 1 day turnaround	23	EA	$320	$7,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	14,250	Ton	$13.00	$185,300
Disposal at Disposal Facility (Non-haz)	assume non-hazardous material	14,250	Ton	$26.00	$370,500
Transport to Disposal Facility (Haz)	assumes transport of material to Model City, NY	7,500	Ton	$25.00	$187,500
Disposal at Disposal Facility (Haz)	disposal of hazardous material	7,500	Ton	$165	$1,237,500
Removal of Access Roads, Staging Area #2, and Dewatering Pits					
Excavate Gravel	1 CY bucket	5,068	BCY	$14.65	$74,300
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	7,463	Ton	$13.00	$97,100
Disposal at Disposal Facility (Non-haz)	assume non-hazardous material	7,463	Ton	$26.00	$194,100
Transport to Disposal Facility (Haz)	assumes transport of material to Model City, NY; assume half of the gravel in the sediment pits will need to be disposed of as hazardous	139	Ton	$25.00	$3,500
Disposal at Disposal Facility (Haz)	disposal of hazardous material	139	Ton	$165	$23,000
Restoration of Access Roads (Access Roads 5 and 6) and Staging Area #2					
Topsoil (Material)	For access roads; assume 8" of material	1,072	LCY	$16.25	$17,500
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,072	LCY	$24.00	$25,800

Table 2-5B Cost Estimate, Alternative 2 - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; Dam and Pump Around Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	1,072	LCY	$1.85	$2,000
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	932	ECY	$2.82	$2,700
Finish grading, large areas		4,194	SY	$0.72	$3,100
Hydroseeding large areas		4,194	SY	$0.39	$1,700
Restoration of Access Roads Along Creek Banks and Dewatering Pits	To be performed in conjunction with bank stabilization on the adjacent upland properties; included in cost estimates for those OUs				
Bank Stabilization for Eighteenmile Creek (for entire length of creek, within the creekbed to the bankfull elevation. Costs for stabilization of soils upland of the bankfull elevation are included with the estimates for remediation of the adjacent properties)					
Synthetic geotextile	Geotextile fabric; Assume extends 10' horizontally into the creek from the bankfull elevation; includes anchoring	8,889	SY	$2.58	$23,000
Clean Stone	Small to medium sized stone for repair of banks and anchoring geotextile fabric.	2,556	LCY	$55.00	$140,600
Plantings	live stakings one per foot; along both banks	8,000	LF	$2.15	$17,200
Replacement Hydraulic Controls					
Engineered Rock Riffles	to control hydraulic gradient in place of Clinton Street Dam; assumed to have crest height of 24" and sloped downstream for 40 feet; assume 8 are needed				
Stone (Heavy)	DOT heavy sized	36	LCY	$96.56	$3,500
Stone (Light)	DOT light sized	356	LCY	$78.27	$27,900
Haul Material	12 CY dump truck, 20 miles round trip, 0.4 load/hr	391	LCY	$24.00	$9,400
Place / Spread Stone	Front end loader, 3 CY bucket	391	LCY	$9.10	$3,600
				Capital Cost Subtotal:	$8,216,115
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$8,142,170
				25% Legal, administrative, engineering fees, construction management:	$2,035,600
				25% Contingencies:	$2,544,500
				Capital Cost Total:	**$12,722,300**
				Capital Cost Total (2009 Dollars):	**$13,111,000**
Annual Costs					
Site Monitoring	Visual survey of creek banks, etc., assume 2-persons @ $100/hr; 10 hr/day for 1 day per each of 2 events	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$5,946
				10% Legal and Administrative fees:	$600
				25% Contingencies:	$1,700
				Annual Cost Total:	**$8,300**
				30-year Present Worth of Annual Costs:	**$169,200**
				30-year Present Worth of Annual Costs (2009 Dollars):	**$175,000**
Periodic Costs (Every 5 Years)					
Sediment Sampling	5 sediment samples; assume 5 locations/day, 2-persons @ $100/hr, 10hr/day	1	Events	$2,000	$2,000
Analytical Costs (PCBs and metals)	Samples from 10 sediment locations; standard turnaround	5	EA	$200	$1,000
Data Evaluation and Reporting		20	HR	$100	$2,000
Creek Bank Repair	Assume 5% of initial costs for bank stabilization	1	LS	$9,100	$9,100
				Periodic Cost Subtotal:	$14,100
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$13,973
				10% Legal and Administrative fees:	$1,400
				25% Contingencies:	$3,900
				Periodic Cost Total:	**$19,300**
				30-year Present Worth of Periodic Costs:	**$93,400**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$97,000**
				2009 Total Present Worth Cost:	**$13,383,000**

Notes:

1. For access roads, assume the 4 access roads constructed for remediation of upland soils on adjacent properties will be used. Additionally, 2 other access roads will be constructed downstream near the Former Flintkote Plant Property.

Length Access Road 5	125 ft	
Length Access Road 6	200 ft	
Access roads along both sides of creek	8000 ft	
Access road width (assumed):	20 ft	
TOTAL ACCESS ROAD AREA:	166,500 SF, or	18,500 SY

2. Assume access roads 5 and 6 will need clearing and grubbing; Assume access roads along creek will already be cleared and grubbed during remediation of upland terrestrial properties, with the exception of the area downstream

3. Assume the staging area constructed for remediation of the upland terrestrial properties will be used. Costs for this staging area are included in cost estimates for remediation of those properties.

4. Assume an additional staging area (Staging Area #2) will be constructed at the northern end of the site to facilitate sediment excavation.

Staging area is approx:	125 ft X	250 ft
	31,250 SF, or	0.7 acres

4. Assume parts of both staging areas will be converted into sediment dewatering pits. Assume:

4 pits
100 ft length
25 ft wide
3 ft deep
6 in thick layer of stone

5. Total contaminated sediment volume:	14,500 BCY
Volume of hazardous sediment	5,000 BCY
Volume of non-hazardous sediment	9,500 BCY

6. Soil excavated for the sediment dewatering pits will be backfilled in its original location, thus eliminating the need to import fill material.

7. Construction duration estimate (assumes standard 5-day work week):

2 construction seasons, 6 months each

Table 2-5B Cost Estimate, Alternative 2 - Complete Removal of Contaminated Sediment to "Pre-Disposal" Conditions, Off-site Disposal, Bank Stabilization and Continued Monitoring, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York; Dam and Pump Around Diversion Method

Description	Comments	Quantity	Units	Unit Cost	Cost
8. Length of Creek		4,000	ft		
9. Bank Dimensions					
age Depth at Bankfull Elevation		3	feet		
Assumed Width from Bankfull Elevation to bottom of cree		5	feet		
Assume banks slope linearly from bankfull elevation to creek bed.					
10. Assumed average number of vertically stacked rows of dam bags to account for water depths greater than 4'		2			
11. Average Creek Width		30	feet		
12. Conversion from BCY to LCY (dewatered material):		1.15	LCY/BCY		
13. Conversion from BCY to tons (dewatered material):		1.5	tons/BCY		
14. Conversion from BCY to LCY (saturated material):		1.12	LCY/BCY		
15. Conversion from BCY to tons (saturated material):		1.7	tons/BCY		
16. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).					
17. Costs presented are based on conventional contracting methods.					
18. Assumed pore space for sediments (assume sand)		35	%		
19. Conversion from CY to gallons		202	gallons/ CY		
20. Unit costs obtained from 2008 RS Means Cost Data books. To adjust these unit costs to 2009, a historical cost index was applied.					
		2008	180.4		
		2009	185.9		
21. Assumed Dimensions/Properties for Clinton Street Dam (Based on Photos and Site Survey)					
Width		100	feet		
Height		15	feet		
Thickness at Top		5	feet		
Thickness at Base		25	feet		
Material	Reinforced Concrete				
Assume trapezoidal dam cross section					
22. Engineered Riffle Assumptions					
Crest Height		2	feet		
Upstream Slope		25	%		
Downstream Slope		5	%		
Length of Riffle		40	feet		
Average Creek Width		30	feet		
Width of Riffle Toe		40	feet		
Typical Width of DOT Heavy Stone		2	feet		
Volume of Heavy Stone Required		35.6	CY		
Volume of Light Stone Required		355.6	CY		
Number of Riffles Needed		8			

Key:

BCY = Bank cubic yards.	LS = Lump sum.
CY = Cubic yards.	Mo = Month.
EA = Each.	MSF = 1000 square feet.
ECY = Embankment cubic yards.	PCB = Polychlorinated biphenyl.
HR = Hour.	SF = Square feet.
kGal = Thousand gallons.	SY = Square yards.
LCY = Loose cubic yards.	TCLP = Toxicity characteristic leaching procedure.
LF = Linear feet.	WWTP = Wastewater treatment plant.

Table 2-6 Summary of Total Present Worth Values of Alternatives, OU-1, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Alternative 1 No Action	Alternative 2a Complete Removal and Offsite Disposal, Bank Stabilization, and Monitoring; In-channel Diversion	Alternative 2b Complete Removal and Offsite Disposal, Bank Stabilization, and Monitoring; Dam and Pump Around
Total Project Duration (Years)	0	30	30
Capital Cost	$0	$8,507,000	$13,111,000
30-year Present Worth of Annual O&M Cost	$0	$175,000	$175,000
30-year Present Worth of Periodic O&M Cost	$0	$97,000	$97,000
2009 Total Present Worth Value of Alternatives	**$0**	**$8,779,000**	**$13,383,000**

3

OU-3: Former United Paperboard Company Property; OU-4: Upson Park Property; OU-5: White Transportation Property

3.1 Introduction

This section discusses the nature and extent of contamination and the feasibility of remedial alternatives for OU-3: Former United Paperboard Company property; OU-4: Upson Park property, and OU-5: White Transportation property. The limits of these OUs are defined by property boundary lines (Figure 1-1) and the creek bankfull elevation, which was delineated based on visual observations made during the Additional Investigation (EEEPC 2009a). Specifically, these OUs are addressed as source areas of contamination to Eighteenmile Creek sediments which are discussed in Section 2 of this report. These three OUs are typically referred to (in conjunction with OU-6: Water Street Residential Properties; see Section 4) as the upland terrestrial sites.

For the purpose of this report, these three OUs are addressed collectively as they exhibit similar contamination, current use, and anticipated future use. Therefore, remedial actions are expected to be similar for these OUs.

This section of the report is organized as follows:

- Section 3.1 provides the study purpose and the site background information;
- Section 3.2 presents the identification of SCGs for various contaminants and the development of RAOs;
- Section 3.3 evaluates appropriate technologies for the remediation of site contamination and the development of remedial alternatives;
- Section 3.4 discusses the combination of remedial technologies to form remedial alternatives and the detailed analysis of the alternatives;
- Section 3.5 presents a detailed analysis of alternatives;
- Section 3.6 presents a comparative analysis of the alternatives.

3.1.1 Background Information
Site Descriptions and Histories

OU-3, OU-4, and OU-5 are located adjacent to Eighteenmile Creek throughout the Corridor Site. In the late 1800s and early 1900s, the properties were used for paper manufacturing and mill operations. The following sections provide a brief description and history of the sites. Additional details concerning the history of these properties can be found in the SRI (EEEPC 2009b) and the Phase 1 Environmental Site Assessment (ESA) reports (EEEPC 2007).

3.1.1.1 OU-3 Former United Paperboard Company Property
The Former United Paperboard Company property is located at 62 and 70 Mill Street. Sixty-two Mill Street is the larger of the two parcels and is bordered by Olcott Street to the north, Mill Street to the east, Clinton Street to the south, and Water Street to the west. The property is currently occupied by Duraline Abrasives, Inc. and contains one warehouse building. Seventy Mill Street is a vacant lot with fill material and building ruins and is bordered by the Former Flintkote Plant site to the north, Mill Street to the east, Olcott Street to the south, and Eighteenmile Creek to the west. Along Mill Street, surface topography is generally flat and the Water Street portion of the property has a steep downward slope toward Eighteenmile Creek (elevation ranges from 470 to 490 feet AMSL). In the late 1880s, the property was used for pulp and box manufacturing.

3.1.1.2 OU-4 Upson Park Property
Upson Park is located at 100 Clinton Street in the city of Lockport, Niagara County, New York. The park is bordered by Clinton Street and a residential area to the north, the West Branch of Eighteenmile Creek and the Barge Canal Authority to the east, the Barge Canal to the south, and a wooded area to the west. The land is currently listed as a town park and along the canal are picnic areas and a walking trail. There is also a parking area, but no standing buildings.

Historical operations at the site included a canal boat building company in the 1880s and subsequent pulp mills in the early 1900s. By 1969, the buildings on the property had been demolished and the property was transformed into its current state. Surface topography at the Upson Park property slopes from Clinton Street to a large parking area, and from the parking area, it has a steep downward slope toward Eighteenmile Creek and a steep upward slope to the west (elevation ranges from approximately 490 to 530 feet AMSL).

3.1.1.3 OU-5 White Transportation Property
The White Transportation property is located at 30-40 Mill Street in the city of Lockport, Niagara County, New York. The property is bordered by the Barge Canal to the south, Mill Street to the east, Clinton Street to the north, and the East Branch of Eighteenmile Creek to the west. Similar to the Upson Park and Former United Paperboard Company properties, historical documents indicate that the parcel was used for pulp and industrial manufacturing until it became the site of a

transportation company in 1952. Transportation operations ceased in the late 1990s; the current property is inactive.

3.1.2 Site Geology and Hydrology

The SRI (EEEPC 2009b) indicates that the terrestrial properties generally consist of mostly glacial tills, and lacustrine silts and clays, with localized areas of fill material overlying bedrock. The overburden also includes areas where massive pieces of bedrock were encountered at depths as shallow as 1 to 3 feet below ground surface (BGS) during the SRI (EEEPC 2009b) and are believed to have been backfilled.

The nature of the overburden was characterized during the SRI (EEEPC 2009b) through split-spoon sampling during borehole drilling. Suspected fill material was observed at the ground surface as well as in the subsurface at varying depths. Two distinct fill units were observed throughout OU-3, OU-4, and OU-5, including:

- Unconsolidated slag material colored dark gray to black, ranging from moderately to well sorted fine to medium sand, with gravel content ranging from zero to 50%. Found at the Upson Park, White Transportation, and Former Flintkote Plant site properties

- Unconsolidated red-brown poorly sorted cinder material containing fragments of red brick, rubber, metal, glass, and buttons found at various locations at the Site but specifically at the Former United Paperboard Company property

Additional possible fill was observed and consisted of gray clay-matrix material containing varying proportions of unsorted sand and fine gravel. The color of the sand and gravel varied between black, gray, brown, tan, red, yellow, and other colors.

The thickness of fill at OU-3, OU-4, and OU-5 was difficult to determine as it was found mixed at different proportions with other overburden material, but it generally ranged from less than 1-foot to more than 10-feet thick.

Native overburden consisted of brown silty, sandy soil with varying dolostone gravel; dark brown silt to silty clay; and dark gray fine silty clay. Observed bedrock consisted of light to dark gray dolostone with interbedded gray clay and no fossils. Bedrock depth ranged from 9 feet to more than 30 feet. Groundwater was found between 6 and 20 feet BGS.

The three terrestrial properties consist of deep, well drained to excessively drained, medium-textured soils. The soils formed in glacial outwash deposits composed primarily of sand and gravel. Approximately 75% of the surface area at the Site is covered by grass/vegetation and some areas of exposed soils and fill, with the other 25% of the surface area covered by buildings and asphalt/stone.

The upland properties slope towards Eighteenmile Creek and therefore are a contributing source of surface runoff and stormwater to the creek.

The Eighteenmile Creek watershed is located within both the Ontario and Huron Plains. Drainage within the watershed can be described as generally flowing to the north. The East Branch of Eighteenmile Creek, which receives a majority of its flow from the Barge Canal, initially flows to the northeast before turning west and merging with the West Branch immediately upstream from Clinton Street. The creek then flows north beneath Clinton Street into the Mill Pond on the Former United Paperboard Company property. Near the Former Flintkote Plant site, the creek channel splits and flows around an island with most of the flow following the channel on the west side of the island. From there, the creek flows downstream and eventually drains into Lake Ontario.

3.1.3 Summary of Previous Investigations

The NYSDEC conducted an RI of the Eighteenmile Creek Corridor Site in 2006, followed by the 2008 SRI (EEEPC). Surface and subsurface soil sampling conducted during these investigations indicated that these three terrestrial properties contain areas of PCBs, metals, and SVOC contaminated soil that appear to be related to the fill in these areas. However, the SRI also determined that the fill is not homogeneous nor is the type of fill consistent with the contamination. For example, high levels of lead contamination were generally found throughout the fill areas, but PCB contamination was identified in only some localized regions of fill.

Sixteen soil samples were collected within the OU-3, OU-4, and OU-5 boundaries during the RI, followed by an additional 49 surface soil and 87 subsurface soil samples during the SRI. The following sections summarize the results of these investigations specific to each OU as well as the overall human health and ecological risk assessments that were conducted as part of the SRI (EEEPC 2009b).

3.1.3.1 OU-3 Former United Paperboard Company Property

Surface Soil Samples

Twenty-one surface soil samples were collected from the Former United Paperboard Company property (12 off-bank surface soil samples along the transects and nine surface soil samples collected at monitoring well locations) during the SRI. PCBs were detected in 14 of the 21 surface soil samples with total PCB concentrations ranging from 0.014 mg/kg to 4.3 mg/kg. Seventeen soil samples contained PCBs at concentrations exceeding the unrestricted use SCO. PCB concentration (Aroclor 1248) in one of these samples also exceeded the higher commercial use SCO. The sample is located near the east bank under the Former United Paperboard Company facility.

Twenty-three metals were detected in the surface soil samples, with 1 metals concentrations exceeding the commercial use SCOs. Lead was detected in all of the

25 surface soil samples at concentrations ranging from 32.0 mg/kg to 3,600 mg/kg, with one sample exceeding NYSDEC hazardous waste criteria.

Additionally, seven SVOCs (six PAHs and dibenzofuran, a PAH-like compound) were detected in the Former United Paperboard Company surface soil samples at concentrations exceeding the unrestricted use SCO. Four samples also contained PAH concentrations exceeding the higher commercial use SCO in at least three samples.

Subsurface Soil Samples

Thirty-seven subsurface soil samples (12 off-bank samples along the transects and 25 at well locations) were collected from the Former United Paperboard Company property during the SRI. PCBs were detected in 11 subsurface soil samples at total PCB concentrations ranging from 0.0047 mg/kg to 626 mg/kg. PCBs were found to exceed the unrestricted use SCO in six subsurface soil samples. Three of these samples contained PCBs at a concentration exceeding the commercial use SCO as well. The maximum concentration (626 mg/kg) was detected at a soil boring installed at the southeast corner of the Former United Paperboard Company property near Clinton Street in an area of fill material. Principal Aroclors detected included 1248 (10 samples), 1254 (five samples), and 1260 (two samples).

Twenty-two metals were detected in the United Paperboard Company subsurface soil samples, 19 of which were found at concentrations exceeding unrestricted use SCOs. Metals detected above the higher commercial use SCOs include: antimony, arsenic, calcium, cobalt, copper, iron, lead, magnesium, mercury, potassium, sodium, and vanadium. Lead was detected in all the property subsurface soil samples at concentrations ranging from 1.7 mg/kg to 7,430 mg/kg. Two TCLP samples exceeded NYSDEC hazardous waste criteria.

Thirty-two SVOCs were detected in the subsurface soil, four of which (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene) were detected at concentrations above the commercial use SCOs.

RI Soil Samples

Soil samples collected during the RI had detections of PCBs, metals, and SVOCs at similar levels as those collected during the SRI.

3.1.3.2 OU-4 Upson Park Property

Surface Soil Samples

Sixteen surface soil samples (12 collected off-bank surface soil samples along the creek transects and four from monitoring well locations) were collected from the Upson Park property during the SRI. PCBs were detected in 10 of the 16 surface soil samples at total PCB concentrations ranging from 0.0097 mg/kg to 0.66

mg/kg**.** PCBs were found at concentrations exceeding the unrestricted use SCO of 0.1 mg/kg in six samples. No samples contained PCB concentrations greater than the restricted commercial use SCO of 1 ppm.

Twenty-two metals were detected in the Upson Park samples. Sixteen metals concentrations exceeded the unrestricted use SCO and 11 metals concentrations exceeded also the higher commercial use SCO. Arsenic, chromium, copper, lead, and zinc were detected in all the samples and lead was present at concentrations ranging from 18.8 mg/kg to 3,480 mg/kg.

Twenty SVOCs, mostly PAHs, were detected in the Upson Park surface soil samples. Seven PAHs were detected above the unrestricted use SCO. One sample contained one PAH (benzo(a)pyrene) at a concentration above the commercial use SCO as well.

Subsurface Soil Samples

Twenty-eight (17 off-bank and 11 borehole) subsurface soil samples were collected during the SRI. PCBs were detected in 14 of the 28 samples at total PCB concentrations ranging from 0.0093 mg/kg to 4.0 mg/kg. PCB concentrations exceeded the unrestricted use SCO in four subsurface soil samples, while the concentration exceeded the higher restricted commercial use SCO in only one sample. This sample was collected on the west side of the Site at a depth of 2.5 to 3 feet.

Metals detected above the higher commercial use SCOs include: antimony, arsenic, barium, cadmium, calcium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, sodium, and vanadium. Lead was detected in all of the subsurface soil samples at concentrations ranging from 7.9 mg/kg to 77,300 mg/kg. One TCLP sample exceeded NYSDEC hazardous waste criteria.

There were seven SVOCs detected in the Upson Park samples, all at concentrations below unrestricted and commercial use SCOs.

RI Soil Samples

Soil samples collected during the RI had detections of PCBs, metals, and SVOCs at similar levels as those collected in the SRI, with the exception of one sample, which had a significantly higher concentration of PCBs (80 mg/kg) and is located on the west bank of the West Branch between SRI transects 1W and 2W.

3.1.3.3 OU-5 White Transportation Property

Surface Soil Samples

Eight (four off-bank along the transects and four at monitoring well locations) surface soil samples were collected from the White Transportation property during the SRI. PCBs were detected in six of the eight surface soil samples at total PCB concentrations ranging from 0.0078 mg/kg to 0.67 mg/kg. Principal Aroclors detected were 1248 (1 sample), 1254 (1 sample), and 1260 (five samples). PCBs were found to exceed the unrestricted use SCO in three samples; however, there were no exceedances over the higher commercial use SCO.

Thirteen metals concentrations exceeded the unrestricted use SCO and eight metals concentrations exceeded the higher commercial use SCO. Arsenic, chromium, copper, lead, and zinc were detected in all the samples and lead was detected at concentrations ranging from 9.7 mg/kg to 3,750 mg/kg. TCLP metals analysis was performed on one sample but TCLP metals concentrations did not exceed NYSDEC hazardous waste values.

There were 23 SVOCs, including 16 PAHs, detected in the White Transportation surface soil samples. Only one sample contained SVOCs (five PAHs) at concentrations above the unrestricted use SCOs. One PAH, benzo(a)pyrene, was detected above the commercial use SCO.

Subsurface Soil Samples
Twenty-one (16 off-bank and five borehole) subsurface soil samples were collected from the White Transportation property during the SRI. PCBs were detected in five subsurface soil samples at total PCB concentrations ranging from 0.012 mg/kg to 0.48 mg/kg. PCB concentrations were found to exceed the unrestricted use SCO in two subsurface soil samples; however, there were no exceedances of the higher commercial use SCO.

Twenty-two metals were detected in the White Transportation subsurface soil samples, 16 of which were found at concentrations exceeding unrestricted and commercial use SCOs. Metals found above the commercial use SCOs include: antimony, barium, calcium, iron, lead, magnesium, potassium, and sodium. Lead was detected in all of the subsurface soil samples at concentrations ranging from 1.7 mg/kg to 2,590 mg/kg. TCLP samples were collected, but they did not exceed NYSDEC hazardous waste values.

Three SVOCs (1,4-dioxane, 4-methylphenol, and phenol) were detected at concentrations exceeding the unrestricted use SCOs. Chlorophenol compounds also were detected at trace levels in these borings. This level of phenol compounds was not observed in any other samples. The concentrations appear to be unique to the White Transportation property. SVOCs were not detected above commercial use SCOs.

RI Soil Samples
Soil samples collected during the RI had detections of PCBs, metals, and SVOCs at similar levels as those collected during the SRI.

3.1.4 Contaminant Fate and Transport
The SRI concluded that transport of fill material from the properties via erosion and runoff appears to be a mechanism for transport of PCBs and metals to the

creek. Additionally, periodic creek flooding may be a source of contamination of floodplain soils at the terrestrial properties. Other sources of contamination to the creek not directly relevant to OU-3, OU-4, and OU-5 are discussed in Section 2, OU-1: Eighteenmile Creek and Millrace.

3.1.5 Qualitative Human Health Risk Evaluation

A qualitative human health exposure risk assessment conducted for the SRI identified four groups of receptors with distinctly different potentials for human exposure to contaminants at OU-3, OU-4, or OU-5 in the Eighteenmile Creek Corridor. These receptors include: visitors to the three terrestrial properties (direct contact with soils); Eighteenmile Creek anglers (direct contact with soils); and site workers at the Former United Paperboard Company property (through direct contact with soils on the Former United Paperboard Company site).

3.1.6 Screening Level Ecological Risk Assessment

The ecological risk assessment presented in the SRI (EEEPC 2009b) determined that the three terrestrial properties contain habitats that are capable of supporting various organisms and wildlife. These ecological receptors could be exposed to the elevated levels of PCBs, copper, lead, and zinc found in floodplain soils.

3.2 Remedial Action Objectives and Identification of Standards, Criteria, and Guidelines

This section identifies the COCs and media of interest specific to OU 3: Former United Paperboard Company property; OU 4: Upson Park property; and OU 5: White Transportation property. It also establishes proposed cleanup goals and specific RAOs for contaminated on-site media and presents estimates of volumes of contaminated media at each property.

3.2.1 Introduction

The RI (NYSDEC 2006a) and SRI (EEEPC 2009b) identified PCB, metals, and SVOC contamination in soils (surface and subsurface soil) at the three terrestrial properties. The SRI further identified potential risks associated with contamination by evaluating contaminant concentrations and identifying exposure routes.

The Human Health Risk Evaluation and Fish and Wildlife Impact Analysis (FWIA) conducted as part of the SRI (EEEPC 2009b) identified the following risks at one or more of the three terrestrial properties:

- Direct contact/incidental ingestion of contaminated soils by visitors to the industrial properties, anglers, and site workers at the Former United Paperboard Company property;

- Direct contact with and uptake from contaminated soils by plants and soil invertebrates; and

- Incidental ingestion of contaminated soils and consumption of contaminated prey by mammals, birds, and reptiles.

RAOs were developed (see Section 3.2.2) to mitigate these potential risks in two ways: by eliminating routes of exposure and/or by reducing the contaminant concentrations in impacted media to meet applicable chemical-specific standards at the site. As such, these chemical-specific cleanup goals were used to determine the volume of material to be addressed to meet the RAOs.

SCGs are used at inactive hazardous waste sites to establish the locations where remedial actions are warranted and to establish cleanup goals. SCGs include state requirements. The following sections present potentially applicable SCGs and other standards and establish proposed cleanup goals and specific RAOs for contaminated on-site media.

3.2.2 Remedial Action Objectives

The RAOs for on-site remedial actions were developed based on information contained in the SRI (EEEPC 2009b), including identified contaminants present in the study area and existing or potential exposure pathways in which the contaminants may affect human health and the environment.

The RAOs for on-site soils are to:

- Reduce to the extent practicable the potential for human and ecological contact with contaminated soils;
- Reduce, to the extent practicable, future recontamination of creek sediments by limiting erosion of terrestrial soils; and
- Achieve proposed cleanup goals for COCs based on an evaluation of ARARs.

3.2.3 Potentially Applicable Standards, Criteria, and Guidelines and Other Criteria

SCGs include ARARs as well as all other applicable requirements.

- **Applicable Requirements** are legally enforceable standards or regulations, such as groundwater standards for drinking water that have been promulgated under state law.
- **Applicable or Relevant and Appropriate Requirements** include those requirements that have been promulgated under state law that may not be "applicable" to the specific contaminant released or the remedial actions contemplated but are sufficiently similar to site conditions to be considered relevant and appropriate. If a relevant or appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.

- **To Be Considered Criteria (TBC)** are non-promulgated advisories or guidance issued by state agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there are no standards or regulations for a particular contaminant or site condition. These criteria may be considered with SCGs in establishing cleanup goals for protection of human health and the environment.

The following sections present the three categories of SCGs: chemical-specific, location-specific, and action-specific.

3.2.3.1 Chemical-Specific SCGs

Chemical-specific SCGs are usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment. They are used to assess the extent of remedial action required and to establish cleanup objectives for a site. Chemical-specific SCGs may be directly used as actual cleanup objectives or as a basis for establishing appropriate cleanup objectives for the COCs at a site. Chemical-specific SCGs for on-site soils at OU-3, OU-4, and OU-5 are discussed in Section 3.2.4.1.

3.2.3.2 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the activities occur in special locations. Examples of location-specific SCGs include building code requirements and zoning requirements. Location-specific SCGs are commonly associated with features such as wetlands, floodplains, sensitive ecosystems, or historic buildings that are located on or close to the site. Location-specific SCGs for OU-3, OU-4, and OU-5 are presented in Table 3-1.

3.2.3.3 Action-Specific SCGs

Action-specific SCGs are usually technology- or activity-based requirements that guide how remedial actions are conducted. These may include record-keeping and reporting requirements; permitting requirements; design and performance standards for remedial actions; and treatment, storage, and disposal requirements. Action-specific SCGs for this site are presented in Table 3-2.

3.2.4 Cleanup Objectives and Volume of Impacted Material

The following sections describe the process used to select numeric cleanup objectives and estimate the volume of impacted material.

Table 3-1 Location-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Criteria/Issues		Citation	Brief Description	Status	Comments
State Location-Specific SCGs					
Environmental Conservation Law	Endangered and Threatened Species	6 NYCRR 182	Lists endangered and threatened species and species of special interest	Not Applicable	Fish and Wildlife Impact Analysis (EEEPC 2009b) indicates no occurrences of rare or endangered species at site
	Freshwater Wetlands	6 NYCRR 663-665	Establishes permit requirement regulations, wetland maps, and classifications	Not Applicable	Fish and Wildlife Impact Analysis (EEEPC 2009b) indicates no state wetlands within Corridor Site
	Floodplain Management Regulations Development Permits	6 NYCRR 500	Describes development permitting requirements for areas in floodplains	Applicable	Floodplains exist along Eighteenmile Creek
	Use and Protection of Waters	6 NYCRR 608	Regulates the modification or disturbance of streams	Applicable	
	Wild, Scenic, and Recreational Rivers	6 NYCRR 666	Regulations for administration and management	Relevant and Appropriate	
	Floodplains	6 NYCRR 502	Contains floodplain management criteria for state projects	Applicable	Floodplains exist along Eighteenmile Creek
Federal Location-Specific SCGs					
National Historical Preservation Act 16 USC Section 469	Preservation of archaeological and historical data	36 CFR Part 65	Action to recover and preserve artifacts	Relevant and Appropriate	
National Historic Preservation Act Section 106 (16 USC 470)	Historic landmarks, property, or projects owned or controlled by federal agencies	36 CFR Part 800	Preserve historic property, minimize harm to National Historic Landmarks	Relevant and Appropriate	
Endangered Species Act of 1973 16 USC 1531, 661	Endangered and Threatened species	50 CFR Part 200, 402 33 CFR Parts 320-330	Determine presence and conservation of endangered species	Not Applicable	Fish and Wildlife Impact Analysis (EEEPC 2009b) indicates no occurrences of rare or endangered species at site

Table 3-1 Location-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

	Criteria/Issues	Citation	Brief Description	Status	Comments
Clean Water Act Section 404	Wetland Protection	40 CFR Parts 230 33 CFR Parts 320-330	Action to prohibit discharge into wetlands	Not Applicable	No federal wetlands in Corridor Site
Clean Water Act Part 6 Appendix A	Wetland Protection	40 CFR Part 6 Appendix A, section 4	Avoid adverse effects, minimize potential harm, preserve and enhance wetlands	Not Applicable	No federal wetlands in Corridor Site
Floodplain Management	Executive Order No. 11988	40 CFR 6.302 (b) (2005)	Regulates activities in a floodplain	Applicable	Floodplains exist along Eighteenmile Creek

Key:
CFR = Code of Federal Regulations.
NYCRR = New York Codes, Rules and Regulations.
OU = Operable Unit
SCG = Standards, criteria, and guidelines.

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Local Action-Specific SCGs					
Lockport City Code	Demolition of Buildings	Chapter 68	Involves permitting and requirements for removal of buildings and structures	Applicable	Applicable to removal of dams and structures within the Corridor Site
	Environmental quality review	Chapter 92	General regulations regarding environmental projects conducted within the city	Applicable	
	Noise	Chapter 125	Places restrictions on unnecessary noise during certain time periods	Applicable	Potential restrictions on noise from construction equipment/vehicles
	Parks	Chapter 129	Regulates various activities conducted in city parks	Applicable	Applicable to activities conducted at the Upson Park property
	Sewers	Chapter 150	Regulates discharge of waters to city sewers	Relevant and Appropriate	
	Streets and Sidewalks	Chapter 158	Regulates alterations of roads and sidewalks including excavation, widening, etc.	Relevant and Appropriate	
	Trees	Chapter 176	Regulates cutting down and planting trees on public land	Applicable	Applicable to clearing and restoration activities along Upson Park property
	Vehicles and Traffic	Chapter 183	Places restrictions on truck traffic throughout the city and defines weight limits on certain streets	Applicable	Applicable to any transporting of wastes off site via truck
	Water	Chapter 185	Places restrictions on access and use of city water mains	Relevant and Appropriate	Applicable to construction activities or technologies requiring access to water
State Action-Specific SCGs					
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law, Articles 3 and 19	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels	Applicable	Applicable to noise from over-the-road vehicles

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Environmental Conservation Law, Articles 3 and 19	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200-202	Establishes general provisions and requires construction and operation permits for emission of air pollutants	Relevant and Appropriate	
Environmental Conservation Law, Article 15; also Public Health Law, Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257	Part 256: New York Ambient Air quality Classification System Part 257: Air quality standards for various pollutants including particulates and non-methane hydrocarbons	Applicable	Applicable to remediation activities at the site that include a controlled air emission source
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions; includes identification of “beneficial use” potentially applicable to non-hazardous oily waste/soil (360-1.15); 360-2: Regulates construction and operation of landfills, including construction and demolition debris landfills	Applicable	Applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous soil and debris
New York Waste Transport Permit Regulations	Permitting Regulations, Requirements and Standards for Transport	6 NYCRR 364	The collection, transport, and delivery of regulated waste, originating or terminating at a location within New York, will be governed in accordance with Part 364	Applicable	Applicable for transporting wastes offsite
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System - General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 - 374, 376	Applicable	
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste (PCBs) and lists specific wastes	Applicable	Applies to transportation and all other hazardous waste management practices in New York State; Hazardous material has been identified on site

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and record keeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities	Applicable	Applicable to transportation of hazardous material offsite
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage, and disposal of hazardous waste	Applicable	Applicable to off-site treatment/disposal of hazardous waste
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes (Subpart 374-2 establishes standards for the management of used oil)	Applicable	
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act Articles 301 and 305	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry site, provides exception from NYSDEC permits; Part 375-6.8: provides soil cleanup objectives used for this report	Applicable	Part 375-6.8 provides soil cleanup objectives used for this report
Environmental Conservation Law, Articles 3 and 27	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes that are restricted from land disposal; Defines treatment standards for hazardous waste	Applicable	Hazardous material has been identified on site
New York Environmental Quality Review Regulations		6 NYCRR 617	Implements provisions of State Environmental Quality Review Act	Applicable	
Implementation of SPDES Program in New York	General Permit for Stormwater	6 NYCRR 750-758	Regulates permitted releases into waters of the state	Applicable	

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Primary and Principal Aquifer Determinations (5/87)		NYSDEC TOGS 2.1.3	Provides guidance on determining water supply aquifers in upstate New York	Not Applicable	There are no primary aquifers in Niagara county.
Environmental Justice and Permitting	Environmental Justice	Commissioner Policy 29	Policy incorporates environmental justice concerns into NYSDEC's public participation provisions and application of the State Environmental Quality Review Act (SEQR)	Applicable	
Federal Action-Specific SCGs					
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions	Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations; Includes training requirements and construction safety requirements	Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities that fall under jurisdiction of the National Contingency Plan
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination with Other Agencies	Delegates authority under CERCLA and the NCP to federal agencies	Relevant and Appropriate	
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb)	Applicable	Applicable to emissions from equipment and remediation systems

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants; Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants	Applicable	Applicable to emissions from equipment and remediation systems
Toxic Substances Control Act	Rules for Controlling PCBs	40 CFR 761	Provides guidance on storage and disposal of PCB-contaminated materials	Applicable	PCBs are contaminants of concern at the site
RCRA	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste	Relevant and Appropriate	Relevant and appropriate to disposal at offsite solid waste landfills
	Hazardous Waste Management System - General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268	Applicable	Applicable to remedial alternatives that involve generation of a hazardous waste (e.g., contaminated soil)
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes that are subject to regulation as hazardous wastes	Applicable	
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste	Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards that apply to persons transporting manifested hazardous waste within the United States	Applicable	Applicable to alternatives involving off-site disposal of hazardous wastes
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards that define acceptable management of hazardous waste	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities

Table 3-2 Action-Specific SCGs, OU-3, OU-4, and OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Standards for Owners of Hazardous Waste Facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Hazardous Waste Permit Program	40 CFR 270, 124	EPA administers hazardous waste permit program for CERCLA/Superfund Sites; Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
Clean Water Act	EPA Pretreatment Standards	40 CFR 403	Establishes responsibilities of federal, state, and local government to implement National pretreatment standards to control pollutants that pass through to a POTW	Relevant and Appropriate	Relevant and appropriate to discharges made to a POTW

Key:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
CFR = Code of Federal Regulations.
EPA = (United States) Environmental Protection Agency.
NYCRR = New York Codes, Rules and Regulations.
NYSDEC = New York State Department of Environmental Conservation.
OSHA = Occupational Safety and Health Administration.
OU = Operable Unit.
PCB = Polychlorinated biphenyl.
PCE = Perchloroethylene.
POTW = Publicly Owned Treatment Works.
RCRA = Resource Conservation and Recovery Act.
SCG = Standards, criteria, and guidelines.
SEQR = State Environmental Quality Review Act
SPDES = State Pollutant Discharge Elimination System.
TCE = Trichloroethylene.
TOGS = Technical and Operational Guidance Series.

3.2.4.1 Selection of Soil Cleanup Goals

Standards

Numeric cleanup goals identified for soils at OU-3, OU-4, and OU-5 are contained in New York Codes, Rules, and Regulations (NYCRR) Part 375-6.8 (NYSDEC 2006d). This regulation presents soil cleanup objectives (SCOs) for protection of ecological resources, groundwater, and public health. The public health criteria are based on land use criteria, which include:

- **Unrestricted use.** A use without imposed restrictions, such as environmental easements or other land use controls; or

- **Restricted use.** A use with imposed restrictions, such as environmental easements, which, as part of the remedy selected for the site, require a site management plan that relies on ICs or engineering controls to manage exposure to contamination remaining at a site. Restricted use is separated into four different categories:

  1. **Residential use.** A land use category that allows a site to be used for any use other than raising livestock or producing animal products for human consumption. Restrictions on the use of groundwater are allowed, but no other institutional or engineering controls relative to the residential SCOs, such as a site management plan, would be allowed. This land use category will be considered for single family housing;

  2. **Restricted-Residential use.** A land use category that shall only be considered when there is common ownership or a single owner/managing entity of the site. Restricted-residential use shall, at a minimum, include restrictions which prohibit any vegetable gardens on a site, although community vegetable gardens may be considered with NYSDEC's approval and single family housing. Active recreational uses, which are public uses with a reasonable potential for soil contact, such as parks, are also included under this category;

  3. **Restricted-Commercial use.** A land use category for the primary purpose of buying, selling, or trading of merchandise or services. Commercial use includes passive recreational uses, which are public uses with limited potential for soil contact; and

  4. **Restricted-Industrial use.** A land use category for the primary purpose of manufacturing, production, fabrication or assembly process and ancillary services. Industrial uses do not include any recreational component.

According to the city of Lockport zoning map (City of Lockport 2006), OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Based on these land uses, the conservative 6 NYCRR Subpart 375 – 6.8 SCOs selected for these OUs are restricted-commercial (due to Upson Park). In addition, SCOs presented in 6 NYCRR Subpart 375-6.8 for the protection of groundwater and ecological resources will be considered where applicable. Because groundwater is not a media of concern at the site, SCOs for the protection of groundwater were not considered.

It is assumed that active remedial alternatives will include bank stabilization measures along the length of Eighteenmile Creek in order to limit upland soils from eroding to the creek and causing recontamination as soil cleanup goals are higher than sediment cleanup goals. This includes soils that have contaminant concentrations below selected commercial cleanup goals for soils, but above sediment guidance values. Therefore, it is assumed that these bank stabilization and active remediation measures will be protective of ecological resources; SCOs for the protection of ecological resources will not be specifically considered.

In order to meet the stated objective of 6 NYCRR Subpart 375 – 2.8, SCOs for unrestricted use were considered in the development of an "Unrestricted Use Alternative" for comparison purposes.

The cleanup goals for the contaminants at OU-3, OU-4, and OU-5 are presented in Tables 3-3, 3-4, and 3-5 respectively.

Criteria and Guidance Values

Guidance values identified for soils are contained in NYSDEC TAGM 4046 (NYSDEC 1994). Criteria and guidance values for the contaminants detected at this site are presented in Tables 3-3, 3-4, and 3-5.

Background

Background soil sample data are used as cleanup objectives when standards and guidance values are not available. Background samples were collected as part of the site investigation of the Former Flintkote Plant site (TVGA 2005) and are used where applicable. Additionally, published soil background values from the New York State (NYS) Brownfield cleanup program (NYSDEC 2006c) and Eastern United States background levels (Shacklette and Boerngen 1984) were used as representative background values when site background was not available.

Selection Process

The selected cleanup goals for soils are presented in Tables 3-3, 3-4 and 3-5. These values are used later in this report to calculate remedial volumes and subsequent costs. The following logical basis was used to select the preliminary cleanup values:

Table 3-3 Cleanup Goals for Soils, OU-3: Former United Paperboard Company Property, Eighteenmile Creek Corridor Site, Lockport, New York

Analyte	NYSDEC Cleanup Goals[a] Protection of Public Health - Commercial	NYSDEC Cleanup Goals[a] Protection of Ecological Resources	NYSDEC Cleanup Goals[a] Unrestricted Use	NYSDEC TAGM 4046[b]	Site Background[c]	New York State Background[d]	Maximum Concentration[e]	Reference RI[f]	Reference SRI[g]	Selected Cleanup Goal
Total PCB by Method 8082 (mg/kg)										
Total PCBs	1	1	0.1	1 / 10	ND	-	630		X	**1**
SVOCs by method SW8270C (mg/kg)										
Benzo(a)anthracene	5.6	-	1	0.224	0.18 J	0.16	54 J		X	**5.6**
Benzo(a)pyrene	1	2.6	1	0.061	0.037 J	0.12	46 J		X	**1**
Benzo(b)fluoranthene	5.6	-	1	1.1	0.24	0.36	60 J		X	**5.6**
Dibenzo(a,h)anthracene	0.56	-	0.33	0.014	0.044 J	< 0.044	9.2 J		X	**0.56**
Indeno(1,2,3-cd)pyrene	5.6	-	0.5	3.2	0.036 J	0.076	30 J		X	**5.6**
Metals by Method 6010/7471 (mg/kg)										
Aluminum	-	-	-	SB	11,670	15,800	12,600		X	**11,670**
Antimony	-	-	-	SB	1.8	2.17	980 J		X	**1.8**
Arsenic	16	13	13	7.5	6.0	12	123 J		X	**16**
Barium	400	433	350	300	85.6	165	6,410		X	**400**
Cadmium	9.3	4	2.5	1	ND	2.4	12.7		X	**9.3**
Calcium	-	-	-	SB	4,305	9,190	217,000		X	**4,305**
Chromium	400	1	1	10	14.0	20	108 J			-
Copper	270	50	50	25	18.2	32	1600		X	**270**
Iron	-	-	-	2,000	17,300	25,600	234,000		X	**2,000**
Lead	1,000	63	63	SB	53.1	72	7430		X	**1,000**
Magnesium	-	-	-	SB	3,360	5,130	144,000		X	**3,360**
Mercury	2.8	0.18	0.18	0.1	0.005	0.2	9.6 J		X	**2.8**
Potassium	-	-	-	SB	1,260	1,890	2,750		X	**1,260**

Notes:

Shaded values are Contaminants of Concern (COCs)

[a] Cleanup goals obtained from 6 NYCRR Part 375-6.8 Soil Cleanup Objective Tables (NYSDEC December 14, 2006).

[b] NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (Jan 1994) Soil Cleanup Objectives. PCB value in surface soil is 1 ppm and 10 ppm in subsurface soils.

[c] Site background values obtained from samples collected during the Site Investigation of the Former Flintkote Plant site (TVGA 2005).

[d] Background values obtained from NYS background (95th percentile), Source-Distant Data Set from NYS Brownfield Cleanup Program, Technical Support Document, Appendix D, (NYSDEC September 2006) for metals presented except thallium and antimony for which background values were obtained from Eastern United States background (95th percentile) (Shacklette and Boerngen 1984).

[e] Concentration listed is the maximum detected value from surface soil, off-bank or subsurface soil samples collected during the SRI (EEEPC 2008) and RI (NYSDEC 2006).

[f] Maximum concentration for a particular contaminant was observed in data collected and reported in the RI Report (NYSDEC 2006a).

[g] Maximum concentration for a particular contaminant was observed in data collected and reported in the SRI (EEEPC 2008).

Key:

J = Estimated value.
mg/kg = Milligrams per kilogram.
ND = Non-detect.
NYCRR = New York Codes, Rules and Regulations.
NYS = New York State.
NYSDEC = New York State Department of Environmental Conservation.
OU = Operable Unit.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
SB = Site background.
SRI = Supplemental Remedial Investigation (EEEPC 2008).
SVOC = Semivolatile organic compound.
"-" = Not Applicable

Table 3-4 Cleanup Goals for Soils, OU-4: Upson Park Property, Eighteenmile Creek Corridor Site, Lockport, New York

Analyte	NYSDEC Cleanup Goals[a]: Protection of Public Health - Commercial	NYSDEC Cleanup Goals[a]: Protection of Ecological Resources	NYSDEC Cleanup Goals[a]: Unrestricted Use	NYSDEC TAGM 4046 [b]	Site Background [c]	New York State Background [d]	Maximum Concentration [e]	Reference: RI[f]	Reference: SRI[g]	Selected Cleanup Goal
Total PCB by Method 8082 (mg/kg)										
Total PCBs	1	1	0.1	1 / 10	ND	-	80	X		**1**
Metals by Method 6010/7471 (mg/kg)										
Aluminum	-	-	-	SB	11,670	15,800	15,100 J		X	**11,670**
Antimony	-	-	-	SB	1.8	2.17	795 J		X	**1.8**
Arsenic	16	13	13	7.5	6.0	12	81.2	X		**16**
Barium	400	433	350	300	85.6	165	3,260 J		X	**400**
Cadmium	9.3	4	2.5	1	ND	2.4	21.7		X	**9.3**
Calcium	-	-	-	SB	4,305	9,190	211,000		X	**4,305**
Chromium	400	1	1	10	14.0	20	918 J		X	**400**
Cobalt	-	-	-	30	7.8	13	59		X	**30**
Copper	270	50	50	25	18.2	32	20,100 J		X	**270**
Iron	-	-	-	2,000	17,300	25,600	246,000 J		X	**2,000**
Lead	1,000	63	63	SB	53.1	72	77,300 J		X	**1,000**
Magnesium	-	-	-	SB	3,360	5,130	63,100 J		X	**3,360**
Mercury	2.8	0.18	0.18	0.1	0.005	0.2	21.5	X		**2.8**
Nickel	310	30	30	13	17.6	25	1,090 J		X	**310**
Potassium	-	-	-	SB	1,260	1,890	2,810		X	**1,260**
Sodium	-	-	-	SB	66.8	211	1,430		X	**67**

Notes:

Shaded values are Contaminants of Concern (COCs)

[a] Cleanup goals obtained from 6 NYCRR Part 375-6.8 Soil Cleanup Objective Tables (NYSDEC December 14, 2006).

[b] NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (Jan 1994) Soil Cleanup Objectives. PCB value in surface soil is 1 ppm and 10 ppm in subsurface soils.

[c] Site background values obtained from samples collected during the Site Investigation of the Former Flintkote Plant Site (TVGA 2005).

[d] Background values obtained from NYS background (95th percentile), Source-Distant Data Set from NYS Brownfield Cleanup Program, Technical Support Document, Appendix D, (NYSDEC September 2006) for metals presented except thallium and antimony for which background values were obtained from Eastern United States background (95th percentile) (Shacklette and Boerngen 1984).

[e] Concentration listed is the maximum detected value from surface soil, off-bank or subsurface soil samples collected during the SRI (EEEPC 2008) and RI (NYSDEC 2006).

[f] Maximum concentration for a particular contaminant was observed in data collected and reported in the RI Report (NYSDEC 2006a).

[g] Maximum concentration for a particular contaminant was observed in data collected and reported in the SRI (EEEPC 2008).

Key:

E = Estimated concentration due to presence of interference (inorganics)
J = Estimated value.
mg/kg = Milligrams per kilogram.
N = Spike sample recovery or spike analysis is not within quality control limits (inorganics).
NYCRR = New York Codes, Rules and Regulations.
NYS = New York State.
NYSDEC = New York State Department of Environmental Conservation.
OU = Operable Unit.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
ppm = Parts per million.
RI = Remedial Investigation (NYSDEC 2006a).
SB = Site background.
SRI = Supplemental Remedial Investigation (EEEPC 2008).
"-" = Not Applicable

Table 3-5 Cleanup Goals for Soils, OU-5: White Transportation Property, Eighteenmile Creek Corridor Site, Lockport, New York

Analyte	NYSDEC Cleanup Goals[a] Protection of Public Health-Commercial	Protection of Ecological Resources	Unrestricted Use	NYSDEC TAGM 4046[b]	Site Background[c]	New York State Background[d]	Maximum Concentration[e]	Reference RI[f]	SRI[g]	Selected Cleanup Goal
Total PCB by Method 8082 (mg/kg)										
Total PCBs	1	1	0.1	1 / 10	ND	-	0.67		X	-
SVOCs by method SW8270C (mg/kg)										
Benzo(a)pyrene	1	2.6	1	0.061	0.037 J	0.12	1.1 J		X	**1**
Metals by Method 6010/7471 (mg/kg)										
Aluminum	-	-	-	SB	11,670	15,800	12,300 J		X	**11,670**
Antimony	-	-	-	SB	1.8	2.17	5.5 J		X	**1.8**
Arsenic	16	13	13	7.5	6.0	12	30.3	X		**16**
Barium	400	433	350	300	85.6	165	415 J		X	**400**
Calcium	-	-	-	SB	4,305	9,190	242,000		X	**4,305**
Chromium	400	1	1	10	14.0	20	411 J		X	**400**
Copper	270	50	50	25	18.2	32	244 J		X	**-**
Iron	-	-	-	2,000	17,300	25,600	74,600 J	X		**2,000**
Lead	1,000	63	63	SB	53.1	72	3750 J		X	**1,000**
Magnesium	-	-	-	SB	3,360	5,130	37,800 J		X	**3,360**
Potassium	-	-	-	SB	1,260	1,890	2,070 J		X	**1,260**
Sodium	-	-	-	SB	66.8	211	282		X	**67**

Notes:

Shaded Values are Contaminants of Concern (COCs).

[a] Cleanup goals obtained from 6 NYCRR Part 375-6.8 Soil Cleanup Objective Tables (NYSDEC December 14, 2006).

[b] NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (Jan 1994) Soil Cleanup Objectives. PCB value in surface soil is 1 ppm and 10 ppm in subsurface soils.

[c] Site background values obtained from samples collected during the Site Investigation of the Former Flintkote Plant Site (TVGA 2005).

[d] Background values obtained from NYS background (95th percentile), Source-Distant Data Set from NYS Brownfield Cleanup Program, Technical Support Document, Appendix D, (NYSDEC September 2006) for metals presented except thallium and antimony for which background values were obtained from Eastern United States background (95th percentile) (Shacklette and Boerngen 1984).

[e] Concentration listed is the maximum detected value from surface soil, off-bank or subsurface soil samples collected during the SRI (EEEPC 2008) and RI (NYSDEC 2006).

[f] Maximum concentration for a particular contaminant was observed in data collected and reported in the RI Report (NYSDEC 2006a).

[g] Maximum concentration for a particular contaminant was observed in data collected and reported in the SRI (EEEPC 2008).

Key:

B = Value greater than or equal to the instrument detection limit, but less than the contract required detection limit (inorganics)
E = Estimated concentration due to presence of interference (inorganics)
J = Estimated value.
mg/kg = Milligrams per kilogram.
ND = Non-detect.
NYCRR = New York Codes, Rules and Regulations.
NYSDEC = New York State Department of Environmental Conservation.
OU = Operable Unit.
PCB = Polychlorinated biphenyl.
ppm = Parts per million.
SRI = Supplemental Remedial Investigation (EEEPC 2008).
SVOC = Semivolatile organic compound.
"-" = Not Applicable

- 6 NYCRR Part 375-6.8 restricted-commercial soil cleanup standards were selected as the cleanup goals;
- Where cleanup standards were not available, NYSDEC TAGM 4046 values were selected as the cleanup goal;
- If neither cleanup standards nor guidance values were available, site background values were used as cleanup goals;
- If site background values were not available for a particular contaminant, NYS background values (NYSDEC 2006c) were used as cleanup goals;
- The maximum observed concentration for each compound was then compared to the selected cleanup goal in order to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site-related and whether cleanup is warranted.

3.2.4.2 Selection of Contaminants of Concern

Based on the cleanup goals selected above, it was determined that PCBs and select metals (chromium, copper, and lead) are the primary COCs at these upland OUs.

A review of the Tables 3-3, 3-4, and 3-5 indicate that there are some SVOCs above selected cleanup goals. However, the SRI indicated that concentrations of these contaminants were relatively low and are consistent with concentrations typically associated with urban activities. Furthermore, the RI indicated that the presence of PAHs in soils throughout the site is related to the slag, cinder, and ash fill on these properties, which was also where metals and PCB contamination were found. Therefore, SVOCs will not be considered as primary COCs at these sites.

In addition, there were several other metals detected above proposed cleanup goals, including calcium, iron, magnesium, manganese, potassium, and sodium. These metals are naturally occurring and are not likely to pose a significant threat to human health or the environment. The Human Health Risk Evaluation conducted as part of the SRI determined that the detected levels of these essential elements were substantially below concentrations associated with adverse health effects, and the FWIA did not identify these contaminants as potential risks to ecological resources at these sites. Therefore, these metals will not be considered COCs.

Furthermore, sampling conducted during the SRI indicated detections of antimony and arsenic throughout the commercial properties above selected cleanup goals.

However, there is currently no standard or guidance value for antimony, so background levels were used as cleanup goals. While this background value was exceeded in numerous locations, concentrations were typically not greater than one or two times the background value. The two isolated cases on the Former United Paperboard Company property where concentrations were significantly higher than background, SRI locations SB-14 and 18MC-L9-S04, (795 J mg/kg and 980 J mg/kg, respectively) are co-located with exceedances of lead. As such, remediation of soils exceeding the selected cleanup goal for lead will also address these two elevated detections. Similarly, concentrations of arsenic detected above cleanup goals were typically only one or two times greater than the cleanup criteria. The highest concentrations of arsenic were generally co-located with exceedances of lead and/or copper or were buried several feet below the surface. Therefore, antimony and arsenic will not be considered primary COCs at these properties.

3.2.4.3 Determination of Contaminated Soil Volumes

The volume of contaminated soils at these terrestrial properties was estimated using survey and analytical data collected during the RI (NYSDEC 2006a) and SRI (EEEPC 2009b). Volumes of contaminated soils were estimated in the following manner:

- Contaminant concentrations were compared against the selected cleanup goals presented in Tables 3-3, 3-4, and 3-5;
- Areas of contamination were delineated based on sample exceedances of the primary COCs;
- Transects were drawn perpendicular to the creek in areas of contamination.
- Cross sectional areas of these transects were estimated using analytical data;
- Volume of contaminated material between transects was estimated by averaging the cross-sectional areas of the two transects and multiplying by the distance in between.

Using the method described above, the volume of contaminated soils was estimated to be 4,600 CY for the Former United Paperboard Company property (OU-3), 6,200 CY for the Upson Park property (OU-4), and 100 CY for the White Transportation property (OU-5). The total volume of contaminated soils to be addressed at these OUs is approximately 11,300 CY. The maximum contamination depth is approximately 12 feet BGS and is located near the Clinton Street Dam on the Former United Paperboard Company property. The total area of contamination is approximately 1.5 acres.

The SRI indicated the presence of some hazardous material in OU-3, OU-4, and OU-5 soils, based on samples with PCB concentrations greater than 50 ppm and samples failing the TCLP test for lead. The SRI also concluded that there is no correlation between concentrations of metals in soils and failure of TCLP tests. However, review of the data shows that hazardous material appears to be concentrated in a few select areas, as indicated in Figure 3-1. Approximately 3,800 CY of soil at the Former United Paperboard Company property and 2,100 CY of soil at Upson Park are assumed to be hazardous. The RI and SRI did not investigate the subsurface soil below existing structures at each of these OUs. It is unknown whether this material exceeds selected cleanup goals. For purposes of this FS, these areas were not included in the contaminated soil volume; however, these areas should be addressed during the design phase.

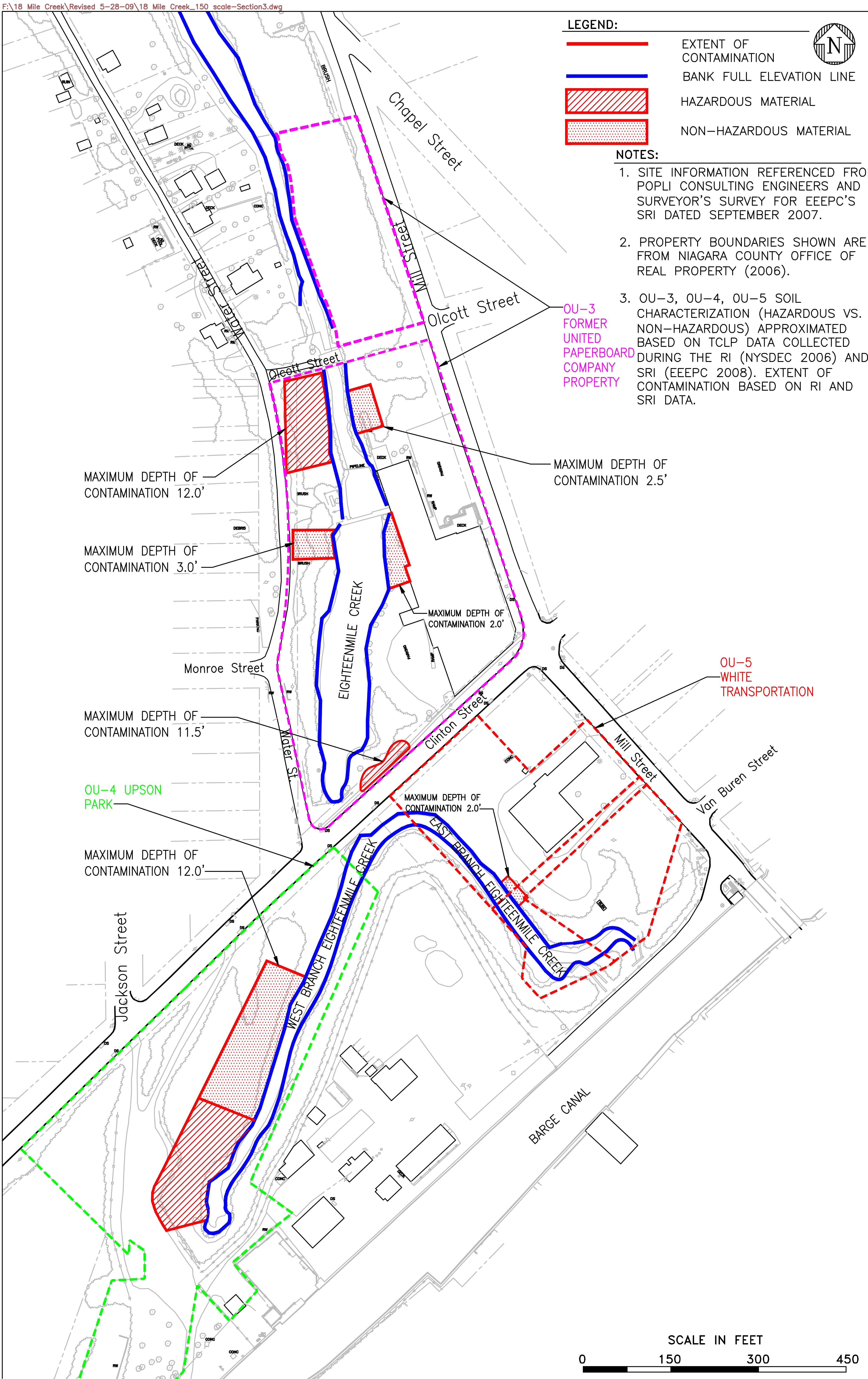
Figure 3-1 provides the extent of contamination to be further addressed in this FS for these OUs.

As mentioned in Section 3.4.2.1, SCOs for unrestricted use were also considered by developing an unrestricted use alternative. The volume of contaminated soils to be remediated under this alternative was determined by the same method outlined above, using unrestricted use SCOs instead of commercial use SCOs. The volume of contaminated soils to be addressed using unrestricted SCOs was estimated to be 39,000 CY for the Former United Paperboard Company property (OU-3), 120,000 CY for the Upson Park property (OU-4), and 34,000 CY for the White Transportation property (OU-5). The total volume of contaminated soils to be addressed is approximately 193,000 CY, with a maximum contamination depth of approximately 26.5 feet BGS, located on the Former United Paperboard Company property. The total area of contamination is approximately 9 acres. Figure 3-6 shows the areas of contamination to be addressed under unrestricted use SCOs.

3.3 Identification and Screening of Remedial Technologies

This section presents the results of the preliminary screening of remedial actions that may be used to achieve the RAOs. Potential remedial actions, including GRAs and remedial technologies are evaluated during the preliminary screening on the basis of effectiveness, implementability, and relative cost. Past performance (e.g., demonstrated technology) and operating reliability were also considered in identifying and screening applicable technologies. Technologies that were not initially considered effective and/or technically or administratively feasible were eliminated from further consideration.

The purpose of the preliminary screening is to eliminate remedial actions that may not be effective based on anticipated on-site conditions or cannot be implemented at the site. The GRAs considered herein are intended to include those actions that are most appropriate for the site and, therefore, are not exhaustive.



ecology and environment

FIGURE 3-1 EXTENT OF CONTAMINATION, UPLAND TERRESTRIAL SOILS, COMMERCIAL USE SCOS,
EIGHTEENMILE CREEK CORRIDOR SITE
LOCKPORT, NEW YORK

3.3.1 General Response Actions

Based on the information presented in the RI (NYSDEC 2006a) and SRI (EEEPC 2009b) and the RAOs established in Section 3.2.2, this section identifies GRAs, or classes of responses for contaminated soils. GRAs describe classes of technologies that can be used to meet the remediation objectives for contaminated site soils. As previously discussed, PCB and select metals contamination in soil are the focus of remedial actions addressed in this section of the report.

GRAs identified for the contaminated soils are as follows:

- No action;
- ICs;
- Containment;
- In situ treatment;
- Ex situ treatment; and
- On- and off-site disposal.

3.3.1.1 Criteria for Preliminary Screening

In accordance with guidance documents issued by NYSDEC (TAGM 4030 and DER-10) and the EPA (Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA [October 1988]), the criteria used for preliminary screening of GRAs and remedial technologies include the following.

- **Effectiveness**. The effectiveness evaluation focuses on the degree to which a remedial action is protective of human health and the environment. An assessment is made of the extent to which an action: (1) reduces the mobility, toxicity, and volume of contamination at the site; (2) meets the remediation goals identified in the RAOs; (3) effectively handles the estimated areas and volumes of contaminated media; (4) reduces impacts to human health and the environment in the short-term during the construction and implementation phase; and (5) has been proven or shown to be reliable in the long-term with respect to the contaminants and conditions at the site. Alternatives that do not provide adequate protection of human health and the environment are eliminated from further consideration.

- **Implementability.** The implementability evaluation focuses on the technical and administrative feasibility of a remedial action. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the site and the availability of necessary equipment and technical specialists. Technical feasibility also includes the future maintenance, replacement, and monitoring that may be required for a remedial action. Administrative feasibility refers to compliance with applicable rules, regulations, statutes, and the ability to obtain permits or approvals from other government agencies or offices and the availability of adequate capacity at permitted treatment, storage, and disposal facilities and related services. Remedial actions that do not appear to be technically or administratively feasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time are eliminated from further consideration.

- **Relative Cost.** In the preliminary screening of remedial actions, relative costs are considered rather than detailed cost estimates. The capital costs and O&M costs of the remedial actions are compared on the basis of engineering judgment, where each action is evaluated as to whether the costs are high, moderate, or low relative to other remedial actions based on knowledge of site conditions. A remedial action is eliminated during preliminary screening on the basis of cost if other remedial actions are comparably effective and implementable at a much lower cost.

The results of the preliminary screening are summarized below.

3.3.2 Identification of Remedial Technologies

This section identifies the potential remedial action technologies that may be applicable to remediation of soils at the terrestrial commercial OUs. Table 3-6 shows a summary of results from the screening of remedial technologies.

3.3.2.1 No Action

The No Action Alternative involves taking no further action to remedy the condition of contaminated soils. NYSDEC and EPA guidance set forth in the CERCLA NCP requires that the No Action Alternative automatically pass through the preliminary screening and be compared to other alternatives in the detailed analysis of alternatives.

3.3.2.2 Institutional Controls and Long-term Monitoring

ICs are non-engineered instruments, such as administrative and/or legal controls, that limit the potential for human exposure to a contaminant by restricting land or resource use (EPA- Office of Solid Waste and Emergency Response [OSWER] 2000). ICs are meant to supplement engineering controls during all phases of cleanup and may be a necessary component of the completed remedy. They typically include environmental easements, covenants, well drilling prohibitions, zoning restrictions, building or excavation permits. Physical barriers like fences that restrict access to sites should also be considered in addition to the ICs.

ICs are not generally expected to be the sole remedial action unless active response measures are determined to be impracticable. However, for these OUs, ICs will be evaluated independently as a stand-alone alternative and will also be considered in conjunction with other engineering alternatives to achieve RAOs.

Table 3-6 Summary of Soil Remedial Technologies, OU-3: Former United Paperboard Company Property; OU-4: Upson Park Property; and OU-5: White Transportation Property, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
No Action	No further action to remedy soil conditions at the site	Ineffective for the protection of human health and the environment	Yes
Institutional Controls and LTM	Include public notification, environmental easements, fencing, and signs	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media	Yes
Containment			
Covering			
Bituminous Concrete Cover (Asphalt)	Selective excavation and/or standard asphalt cover system including layer of stone, asphalt binder course, and final wearing course	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Is more costly than soil cover and the lower permeability offered by this cover is not warranted because groundwater is not a media of concern at these OUs; Will be considered for covering existing roadways and parking areas	Yes
Clay or Soil Cover	Cover system consisting of soil	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media	Yes
6 NYCRR Part 360 Cover	Selective excavation and/or non-RCRA cap typically used to close Municipal Solid Waste Landfills	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Is more costly than soil cover and the lower permeability offered by this cover is not warranted because groundwater is not a media of concern at these OUs	No
6 NYCRR Part 373 (RCRA) Cover	Selective excavation and/or RCRA cap typically required at Hazardous Waste Sites	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Is more costly than soil cover and the lower permeability offered by this cover is not warranted because groundwater is not a media of concern at these OUs	No
In Situ Treatment			
Thermal			
Thermally Enhanced Soil Vapor Extraction (SVE)	Uses electrical resistance/electromagnetic/ radio frequency heating or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors	SVE is not effective in removing non-volatile organics such as PCBs or heavy metals	No

Table 3-6 Summary of Soil Remedial Technologies, OU-3: Former United Paperboard Company Property; OU-4: Upson Park Property; and OU-5: White Transportation Property, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
Thermal Desorption (thermal blankets and wells)	Thermal blankets and thermal wells are placed on contaminated ground surface; A majority of contaminants are vaporized out by thermal conduction; Vapors are drawn out by vacuum system, oxidized, cooled, and passed through activated carbon beds	More expensive than other established remedial technologies; Not effective for remediating inorganics and metals	No
Vitrification	Contaminated soils are melted at extremely high temperatures using probes inserted into the ground delivering an electric current; The soil is heated to extremely high temperatures, and is cooled to form a stable, glassy crystalline mass	Only a few commercial applications of this technology exist. Treatability studies are generally required to determine the effectiveness of ISV as a remediation technology at a given site; End product of the technology may hinder future site use, and there is relatively high implementation cost	No
Physical/Chemical			
Solidification/ Stabilization	Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their "host" medium using chemical reactions instead of removing them through chemical or physical treatment	Stabilization technologies have not been successfully demonstrated on a full-scale basis for treating organics; Solidified material may hinder future site use; Treatability studies would be required prior to implementing this technology	No
Soil Flushing	An extraction process by which organic and inorganic contaminants are washed from contaminated soils through the injection of an aqueous solution into the area of contamination, and the contaminant elutriate is pumped to the surface and removed from the site	Capture of the impacted solution is critical to the effectiveness of this technology; Contamination depths and PCBs strong tendency to adhere to soil particles may limit this technology's effectiveness	No
Biological			
Biological Treatment	Uses indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride	Biological treatment technologies are not well-demonstrated for PCBs and are ineffective for heavy metals; This technology also involves a relatively longer remediation period compared to other treatment technologies	No
Ex Situ Treatment			
Thermal			
High Temperature Thermal Desorption	A physical separation process that uses heat to volatilize organic wastes, which are collected and treated in a gas treatment system	Moderate cost, full-scale technology that has been successfully demonstrated in the field for treatment of PCB contaminated soils; Metals in the impacted soils would require additional stabilization treatment; Lack of available space on site to construct a full scale facility	No

Table 3-6 Summary of Soil Remedial Technologies, OU-3: Former United Paperboard Company Property; OU-4: Upson Park Property; and OU-5: White Transportation Property, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
Incineration	Uses high temperatures to volatilize and destroy organic contaminants and wastes	Has demonstrated success in treatment of PCB contaminated soils but is ineffective for treatment of high concentrations of metals; Is more expensive than other ex situ treatment technologies and would be difficult to implement on site due to a lack of space	No
Vitrification	Thermally melts contaminants at high temperatures using a gas/oxygen power source; Organics such as PCBs and VOCs are destroyed while metals are inertly captured in a crystalline structure; Soils are excavated and stockpiled, and a fluxing agent is introduced to aide in the melting process.	Medium-to-high cost technology that is successful in destroying PCBs, organics and stabilizing metals; The inert glass aggregate byproduct can be returned to the site for backfill or can be sold as a construction aggregate; However, there are no current existing vitrification plants accepting waste, and construction of an on-site facility is not feasible due to high costs and lack of available space.	No
Physical/Chemical			
Dehalogenation	A chemical process that is achieved either by replacement of the halogen molecule of the organic compound or decomposition and partial volatilization of the contaminant through adding and mixing specific reagents.	Although EPA has been developing this technology since 1990, it has not yet been successfully demonstrated in a commercial application and cannot be used to treat metals contamination.	No
Solvent Extraction	A chemical extraction process whereby the target contaminant is physically separated from the soil using an appropriate organic solvent to dissolve PCBs; Other solvents such as acids can be used to separate heavy metals.	This technology has not been commercially implemented, and may require multiple extractions so that solvent-contaminated soils are not returned to the site; Will require multiple solvents to treat both organic and inorganic contaminants; On-site implementation would be challenging due to a lack of space.	No
Soil Washing	A volume reduction technology that segregates the fine solid fractions from the coarser soils through an aqueous washing process and washing water treatment system.	There is not a high level of confidence in the effectiveness of soil washing of PCB contaminated soil and the costs to construct and operate an on-site processing facility are high.	No
Solidification/ Stabilization	Contaminants are physically and chemically bound to native media; Soils are excavated, stockpiled, and mixed with reagents such as asphalt or Portland cement.	Is effective in reducing the mobility of metals; However, is ineffective for treatment of organic contaminants such as PCBs.	No

Table 3-6 Summary of Soil Remedial Technologies, OU-3: Former United Paperboard Company Property; OU-4: Upson Park Property; and OU-5: White Transportation Property, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
On- and Off-site Disposal			
On-site Disposal	Requires construction of a secure landfill that meets RCRA and state requirements.	There is no available space to build an on-site landfill; Construction of an on-site landfill may impact future use of the sites.	No
Off-site Disposal	Involves the excavation and hauling of contaminated material to appropriate commercially licensed disposal facilities. The non-hazardous spoils would go to a non-hazardous/solid waste facility, while the hazardous spoils would go to an RCRA-permitted facility.	Excavation and disposal of contaminated soil at a permitted landfill is an effective method of reducing potential for direct contact with contaminated soils and future contamination of the groundwater. Backfill materials would need to be imported to fill the site.	Yes

Key:

EPA = (United States) Environmental Protection Agency.
ISV = In situ vitrification.
LTM = Long-term monitoring.
NYCRR = New York Codes, Rules and Regulations.
OU = Operable Unit.
PCB = Polychlorinated biphenyl.
RCRA = Resource Conservation and Recovery Act.
SVE = Soil vapor extraction.
VOC = Volatile organic compound.

LTM can refer to the sampling of environmental media or the physical monitoring of the site. LTM is applicable to the terrestrial OUs to ensure erosion is limited to the maximum extent practicable. Therefore, LTM will be further considered for these OUs.

3.3.2.3 Containment

Covering

Containment of impacted soils can be achieved by covering contaminated materials in place and can be combined with other remedial actions including consolidation of contaminated materials. Covering is a means to limit direct contact with impacted material and reduce the potential for rainfall infiltration into groundwater, thus limiting contaminant mobility and exposure. Cover systems can use a variety of materials, including soil, synthetic membranes, asphalt, concrete, and chemical sealants.

Covering of the affected area is generally performed when subsurface contamination at a site precludes excavation and removal of contaminated materials because of potential hazards and/or prohibitive costs. Covering also may be performed as an interim remedial measure to reduce infiltration of precipitation and to control air releases. The main disadvantages of capping are uncertain design life and the need for long-term maintenance and monitoring.

Cover systems (single and multi-layered) considered applicable for these sites include an asphalt cover (single-layered), a clay or soil cover, and cover systems described in 6 NYCRR Part 360, and 6 NYCRR Part 373 (Resource Conservation and Recovery Act [RCRA] cover). These cover systems would be effective in reducing exposure to contaminated soils and preventing infiltration of surface water.

- **Bituminous Concrete Cover (Asphalt).** A standard asphalt cover system typically includes a layer of stone (6 to 8 inches), followed by an asphalt binder course (typically 4 inches), and a final wearing course (typically 2 inches). Site grading is typically required to achieve an adequate slope for drainage. Although asphalt covers serve to limit infiltration into groundwater, they are more permeable than 6 NYCRR Part 360 composite cap and 6 NYCRR Part 373 RCRA cap. Furthermore, asphalt is susceptible to cracking and settlement, and thus would require more O&M in the long term.

- **Clay or Soil Cover.** A clay cover consists of a layer of low permeability clay over the contaminated material. In some cases, clean fill can be used when site RAOs consider limiting direct contact with contaminated soils by human and/or ecological receptors. Typically, the thickness of this layer is between one and 5 feet. This type of cover is designed to prevent the infiltration of water and needs to be graded for proper drainage. Clay and soil covers are not as protective as an asphalt, 6 NYCRR Part 360, or 6 NYCRR Part 373 cap as they are more susceptible to cracking and would require more O&M in the long term.

- **6 NYCRR Part 360 Cover System.** A 6 NYCRR Part 360 cover system is commonly used in NYS to close municipal solid waste landfills. The system consists of the following components:

  1. A 12-inch gas venting layer with a hydraulic conductivity equal to or greater than 1 x 10^{-3} centimeters per second (cm/sec) directly overlying the waste material. A filter fabric is typically directly below and above the venting layer to limit the migration of fines into the venting layer. This layer is intended to transmit methane from high organic waste material.

  2. An 18-inch layer of compacted low permeability barrier soil overlying the gas venting layer with a hydraulic conductivity equal to or less than 1 x 10^{-6} cm/sec.

  3. A synthetic 40-mil or thicker geomembrane overlying the low permeability soil barrier.

  4. A 24-inch compacted soil layer to protect the low-permeability layer and geomembrane from root penetration, desiccation, and freezing.

  5. A final 6-inch layer of topsoil placed on top of the protective layer to promote vegetative growth for erosion control.

- **6 NYCRR Part 373 (RCRA) Cover System.** An RCRA cover system is typically required at hazardous waste sites. An RCRA cover system is most applicable when a significant potential for leaching of contaminants from the unsaturated zone to the saturated zone exists. Basic requirements for cover systems are described in 6 NYCRR Part 373. These requirements are also consistent with Subparts G, K, and N of RCRA of Subtitle C regulations (for hazardous waste). The recommended design for an RCRA Subtitle C cover system consists of the following (from bottom to top):

  1. A low hydraulic conductivity geomembrane/soil layer consisting of a 24-inch-thick layer of compacted natural or amended soil with a hydraulic conductivity of 1 x 10^{-7} cm/sec, and a minimum 20-mil (0.5 mm) geomembrane liner.

  2. A minimum 12-inch-thick soil layer having a minimum hydraulic conductivity of 1 x 10^{-2} cm/sec, or a layer of geosynthetic material having the same characteristics.

  3. Minimum 24-inch-thick top vegetative soil layer.

The following presents the preliminary screening of containment technology:

- **Effectiveness.** Placement of a cover over the contaminated soils would be effective in helping to achieve the RAOs for soil, since it would reduce the potential for direct contact with the contaminated soils and limit erosion and transport of contaminated materials.

- **Implementability.** The materials, equipment, and labor for construction of a cover are available and can be readily implemented.

- **Cost.** Costs for installation of a capping or cover system are relatively low. Capital costs for installing a NYCRR Part 360 cover system are expected to be around $165,000 per acre, while it is $225,000 per acre for an RCRA Subtitle C cover system (Federal Remediation Technologies Roundtable [FRTR] 2002). Costs for a clay or soil cover are less. Capital costs may include materials, labor, and equipment to construct the system. O&M costs would be minimal.

Since containment of contaminated soil via covering is effective in protecting human health and the environment, readily implementable, and relatively cost-effective, it will be retained for further analysis.

The type of cover system that will be further considered is a soil cover. Sampling during the SRI showed that groundwater was not a medium of concern at these sites. Therefore, the low permeability offered by an asphalt cap and the cover system identified in 6 NYCRR Part 360 are not warranted. It is assumed that construction of an RCRA cover is not applicable due to the close proximity to the creek soils considered hazardous. Thus, a soil cover will be retained for further consideration in areas considered non-hazardous because it will reduce exposure to contaminated soils to achieve RAOs at a lower cost of the other cover systems identified. Additionally, an asphalt cover will be retained for further consideration for areas that are currently existing gravel roadways or parking areas. An asphalt cover in these areas would prevent direct contact with contaminated material while forming a better delineation with adjacent soil covers.

3.3.2.4 In Situ Treatment

In situ treatment technologies for soil remediation typically fall in the following three major categories:

- Thermal treatment;

- Physical/chemical treatment; and

- Biological treatment.

The following sections present a discussion of applicable soil remediation technologies under each general response category described above.

3.3.2.4.1 Thermal Treatment

Thermal treatment processes generally involve applying heat to contaminated material to vaporize the contaminants into a gas stream (i.e., physically separate from the host medium), and then treating the gas stream prior to discharge into the atmosphere. Various gas treatment technologies can be used to collect, condense, or destroy the volatilized gases. The three common types of in situ thermal treatment technologies are: in situ thermal desorption (ISTD) using thermal blankets and thermal wells, vitrification using electrodes, and enhanced soil vapor extraction (SVE).

Thermally enhanced SVE is a full-scale technology that uses electrical resistance/electromagnetic/radio frequency heating, or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors. The process is otherwise similar to SVE. However, since SVE does not remove PCBs, heavy hydrocarbons, or heavy metals (only applicable to volatile organic compounds [VOCs] and SVOCs with a Henry's law constant greater than 0.01), it will not be retained for further consideration.

In Situ Thermal Desorption – Thermal Blankets and Thermal Wells

ISTD technology was developed in Shell research labs over the last 25 years as part of its enhanced oil recovery efforts, and has been one of the few in situ forms of thermal desorption technologies that has been demonstrated to work effectively on a commercial scale. At the present time, thermal blankets and thermal wells are proprietary technologies of TerraTherm, Inc., an affiliate of Shell Oil Company. The thermal blanket system consists of electric heating "blankets," approximately 8 by 20 feet, that are placed on top of the contaminated ground surface. The blankets can be heated to 1,800° Fahrenheit (F), and by thermal conduction are able to vaporize most contaminants down to a depth of approximately 3 feet BGS. Vapors are drawn out of the soil and through the blanket system by means of a vacuum system. The contaminated vapors are then oxidized at a high temperature in a thermal oxidizer near the treatment area, and finally cooled and passed through activated carbon beds to collect any trace levels of organics not oxidized prior to discharge to the atmosphere.

Thermal wells use the same process as thermal blankets, except that heating elements are placed in well boreholes drilled at an average spacing of 7 to 10 feet. Similar to the blanket modules, the vacuum is drawn on the manifold so that extracted vapors are collected and destroyed. Estimated ISTD treatment costs obtained from TerraTherm range from $100/CY for a 100,000-CY site to $600/CY for a 1,000-CY site (TerraTherm, Inc. 2007).

ISTD using thermal wells and blankets have been successfully demonstrated by TerraTherm at several PCB-contaminated sites. PCB reduction of 99.9% was achieved from initial concentrations of as high as 20,000 mg/kg at a contamination site in Missouri. However, ISTD has not been shown to be effective in treating soils contaminated with heavy metals other than arsenic and mercury. Since the three terrestrial OUs have high levels of lead, copper, and chromium contamination in addition to PCBs, other treatment methods would need to be applied in addition to ISTD to remediate these contaminants, resulting in much higher costs and cleanup times. Therefore, ISTD will not be retained for further consideration.

In Situ Vitrification

In situ vitrification (ISV) is a process which uses electrical power to heat and melt soil contaminated with organics, inorganics, and metal-bearing wastes. The molten material cools to form a hard, monolithic, chemically inert, stable glass, and crystalline product that incorporates the inorganic compounds and heavy metals present in the waste. The organic contaminants within the waste are vaporized or pyrolyzed and migrated to the surface of the vitrified zone where they are oxidized under a collection hood. Residual emissions are captured in an off-gas treatment system.

ISV uses electrodes that are inserted into the ground to the desired treatment depth. Electrical power is charged to the electrodes, which heat the surrounding soil to 2,000ºC, which is above the initial melting temperature of typical soils. With favorable site conditions, it is estimated that a processing depth to 30 feet BGS can be achieved.

Although ISV has been tested for a range of organic and inorganic contaminants, including PCBs, and has been operated for demonstration purposes at the pilot scale, few full-scale applications of this technology exist. Treatability studies are generally required to determine the effectiveness of ISV as a remediation technology at a site. Once vitrified, the original volume of soil would decrease by approximately 20 to 50%, requiring backfilling with clean material, grading, and restoring.

- **Effectiveness.** ISV processing requires that sufficient glass-forming materials (e.g., silicon and aluminum oxides) be present within the contaminated soil to form and support a high-temperature melt. If the natural soil does not contain enough of these materials, then a fluxing agent, such as sodium carbonate, can be added. If metals of high concentrations and/or large dimensions are present in the soil to be treated, the electrodes may short circuit.

  ISV can treat soils saturated with water; however, additional power is required to dry the soil prior to melting. The presence of large inclusions in the area to be treated can limit the effectiveness of the ISV process. Inclusions are highly concentrated contaminant layers, void volumes, containers, metal scrap, general refuse, demolition debris, rock, or other heterogeneous materials within the treatment volume.

- **Implementability.** ISV is considered an emerging technology as there have been very few commercial applications carried out. Four sites have commercially implemented ISV, ranging from bench-scale to full scale systems. A large-scale test was conducted at Hanford, Washington on mixed radioactive and chemical wastes that contained chromium. A fire involving the protective hooding occurred. Materials of construction (e.g., for the collection hood) and electrode-feeding mechanisms are still being tested and developed. Implementation may be hampered due to close proximity to the creek and the presence of heterogeneous material in the fill found throughout OU-3, OU-4, and OU-5.

- **Cost.** Costs of ISV are moderate to high and depend on factors such as the moisture content of the soil, the amount of additives required to create the appropriate mixture for successful treatment, the specific properties of the waste soil, the depth of process, and the unit price of electricity. Vitrification costs at the Hanford, Washington site were approximately $400 per ton of contaminated material. A full scale implementation of ISV to remediate approximately 3,000 CY of material at a site in Grand Ledge, Michigan cost approximately $267 per CY (FRTR 2007).

In summary, since few full-scale applications of this technology exist, this technology has relatively high implementation costs, and implementation would be difficult due to close proximity to the creek; therefore, ISV will not be further considered.

3.3.2.4.2 Physical/Chemical Treatment

A number of in situ physical/chemical treatment processes for soil have been developed to chemically convert, separate, or contain waste constituents. These include solidification/stabilization and soil flushing.

In Situ Solidification/Stabilization

Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their “host” medium instead of removing them through chemical or physical treatment. Solidification is a process whereby contaminants are physically bound or enclosed within a stabilized mass. Stabilization is a process where chemical reactions are induced between the stabilizing agent and contaminants to either neutralize or detoxify the wastes, thus reducing their mobility.

Solidification/stabilization methods used for chemical soil consolidation can immobilize contaminants. Most techniques involve a thorough mixing of the solidifying agent and the waste. Solidification of wastes produces a monolithic block. The contaminants do not necessarily interact chemically with the solidification reagents but are mechanically locked within the solidified matrix. Solidification/stabilization systems have generally targeted inorganics (i.e., heavy metals) and radionuclides, but not PCBs. Stabilization methods usually involve the addition of materials, such as molten bitumen, asphalt emulsion, and Portland cement that limit the solubility or mobility of waste constituents even though the physical handling characteristics of the waste may not be improved. Remedial actions involving combinations of solidification and stabilization techniques are often used to yield a product or material for land disposal, or in other cases, that can be applied to beneficial use. Auger/caisson systems and injector head systems are techniques used to implement in situ solidification/stabilization methods.

- **Effectiveness.** In situ solidification/stabilization systems have generally targeted inorganics (i.e., heavy metals) and radionuclides. The auger/caisson and reagent/injector head systems have limited effectiveness in treating organics although systems are currently being developed and tested for treatment of PCBs.

- **Implementability.** Treatability studies are generally required to assess compatibility of waste material and reagent used.

- **Cost.** In situ solidification/stabilization costs are around $150 to $250 per CY for deeper applications (FRTR 2002). Based on the extent of the contamination and depth of the contaminated soil at the three terrestrial properties, we believe the cost of this treatment alternative would be moderate. Treatability studies would be required to better determine the cost of this alternative in a full-scale operation.

In summary, although this technology has been shown to be effective in reducing the mobility and toxicity of heavy metals, it has not been proven on a full-scale basis for treating organics and PCBs. Since the soils on the three terrestrial properties contain a combination of PCBs and metals, this technology would need to be coupled with other treatments, resulting in higher costs and longer cleanup times. Therefore, in situ solidification/stabilization will not be retained for further consideration.

In Situ Soil Flushing

Soil flushing is an extraction process by which organic and inorganic contaminants are washed from contaminated soils. An aqueous solution is injected into the area of contamination, and the contaminant elutriate is pumped to the surface for removal, re-circulation, or on-site treatment, and re-injection. During elutriation, sorbed contaminants are mobilized into a solution because of solubility, and form an emulsion, or chemical reaction with the flushing solution. An in situ soil-flushing system includes extraction wells installed in the area of contamination, injection wells installed upgradient of the contaminated soil areas, and a wastewater treatment system for treatment of recovered fluids. Similar to solidification/stabilization systems, in situ soil flushing generally targets inorganics (i.e., heavy metals) and radionuclides, not PCBs.

Co-solvent flushing is another type of soil flushing that involves injecting a solvent mixture (e.g., water plus a miscible organic solvent such as alcohol) into the vadose zone, saturated zone, or both to extract organic contaminants. Co-solvent flushing can be applied to soils to dissolve either the source of contamination or the contaminant plume emanating from it.

- **Effectiveness.** The effectiveness of this technology decreases in heterogeneous soils similar to those found at the three terrestrial sites. The tendency of PCBs to adsorb to soil particles also reduces the effectiveness.

- **Implementability.** In situ soil flushing has had very limited commercial success. This technology can be used only in areas where flushed contaminants and soil flushing fluid can be contained or recaptured. Since these OUs are in close proximity to Eighteenmile Creek, there is the potential for wash fluids to discharge to the creek.

- **Cost.** In situ soil flushing is a low cost technology with costs ranging from $25 to $250 per CY (FRTR 2002). Treatability studies would need to be performed to estimate the cost for installing a full-scale system. Also, the above-ground separation and treatment of recovered fluids can drive the cost of the whole process.

In summary, it is believed that in situ soil flushing is not effective in heterogeneous soils found at these properties. Due to its limited success and difficulty in ensuring effectiveness in situ, this technology will not be considered further.

3.3.2.4.3 Biological Treatment

Biological treatment processes use indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride. Available in situ biological treatment technologies include bioventing, enhanced biodegradation (aerobic and anaerobic), natural attenuation, and phytoremediation. A review of completed remediation projects and demonstration projects where biological treatment technologies were used for soil remediation indicates that these technologies have primarily been used for soils contaminated with petroleum hydrocarbons, VOCs (e.g., trichloroethylene [TCE] and perchloroethylene [PCE]), pesticides, and wood preservatives. Bioremediation is known to be ineffective in remediating metals and has not been well demonstrated for PCBs. As such, these technologies will not be retained for detailed analysis.

3.3.2.5 Ex Situ Treatment

Ex situ treatment requires soil to be excavated before treatment. Ex situ treatment allows for greater flexibility in establishing the physical, chemical, or biological conditions; or any combination of these conditions that are required to remove or destroy the contaminant. Treated soils can often be reused either for backfill or other commercial uses, thereby reducing costs. Available ex situ treatment technologies that are potentially applicable to the commercial terrestrial properties include thermal desorption, incineration, vitrification (thermal treatment processes), dehalogenation, solvent extraction (chemical processes), and soil washing (physical process).

3.3.2.5.1 Thermal Treatment

Thermal treatment processes generally involve the application of heat to physically separate, destroy, or immobilize the contaminant. A number of ex situ thermal treatment technologies exist to treat a range of contaminants including high-temperature and low-temperature thermal desorption (LTTD), hot gas decontamination, open burning/open detonation, pyrolysis, and incineration. This section will focus on high-temperature thermal desorption (HTTD), incineration, and vitrification, as these are the most applicable and successfully demonstrated technologies for the types of contamination found at these sites.

Ex Situ High-Temperature Thermal Desorption

Thermal desorption is a physical separation process that uses heat to volatilize organic wastes, which are subsequently collected and treated in a gas treatment system. Thermal desorption differs from incineration because the decomposition or destruction of organic material is not the desired result although some decomposition may occur. Varieties of gas treatment technologies are used to collect, condense, or destroy the volatilized gases. A vacuum system is typically used to transport volatilized water and organics to the treatment system. As described above, thermal desorption technologies can be grouped into HTTD and LTTD systems. LTTD is primarily used for non-halogenated VOCs and SVOCs with low boiling points (i.e., below 600°F), and is not considered an applicable technology for PCB contamination.

HTTD systems are able to heat materials to temperatures in the range of 600°F to 1,200°F, and can target SVOCs, PAHs, and PCBs. In general, thermal systems can be differentiated by the method used to transfer heat to the contaminated material and by the gas treatment system. Direct-contact or direct-fired systems (i.e., rotary dryer) apply heat directly by radiation from a combustion flame. Indirect-contact or indirect-fired systems (i.e., thermal screw conveyor) apply heat indirectly by transferring it from the source (combustion or hot oil) through a physical barrier that separates the heat source from the contaminated material.

Of the several vendors working in the thermal treatment industry, Environmental Soil Management Inc. (ESMI) currently owns and operates three fixed-location thermal treatment facilities in the northeast region, one each in New York, New Jersey, and New Hampshire. In addition, ESMI owns a portable thermal treatment unit that can be transported as needed based on site-specific conditions. Depending on the material volume to be treated and chemical concentrations, material may be more appropriately sent to one facility versus another.

HTTD is a full-scale technology that has been successfully demonstrated in the field for treatment of PCB-contaminated soils. However, heavy metals are not treated by HTTD systems and soils that undergo HTTD treatment may require secondary treatment such as stabilization/solidification or disposal in an approved facility.

Typically, systems that have been used for PCB contamination consist of a rotary dryer (primary chamber) to volatilize the contaminated material, and an after-burner (secondary chamber) where the off-gas is oxidized at temperatures in the range of 1,400°F to 1,800°F. The off-gas is then cooled, or quenched, and passed through a baghouse to remove any trace organics not oxidized prior to discharge into the atmosphere. HTTD units are considered to be incinerators, and must meet RCRA incinerator emission requirements (40 CFR Parts 264 and 265, Subpart O).

- **Effectiveness.** HTTD technology is effective in treating PCB contamination. However, heavy metals are not effectively treated and would, therefore, require additional stabilization/solidification treatment or disposal.
- **Implementability.** As with other ex situ treatment technologies, HTTD would require construction of an on-site treatment facility. Due to logistical factors at these commercial sites, construction of such a facility would be difficult as there is a lack of available space on site. Nearby land would need to be purchased and material would need to be transported to and from these three terrestrial properties.
- **Cost.** HTTD is a moderate cost technology with costs typically ranging from $100 to $300 per CY depending on the volume of contaminated soils (FRTR 2008).

In summary, HTTD is a demonstrated technology for treatment of PCBs, but is ineffective in treating high concentrations of metals and other inorganics. Therefore, additional technologies would need to be combined with HTTD treatment to fully remediate the soils at these sites. This would result in high costs and additional complexities. Furthermore, ex situ HTTD is not easily implementable at these sites due to a lack of available space on the terrestrial properties. Therefore, HTTD will not be retained for further detailed analysis.

Ex Situ Incineration

Incineration uses high temperatures (1,600° to 2,200°F) to volatilize and destroy organic contaminants and wastes. A typical incineration system consists of the primary combustion chamber into which contaminated material is fed and initial destruction takes place, and a secondary combustion chamber where combustion byproducts (products of incomplete combustion) are oxidized and destroyed. From the secondary chamber, the off-gases are drawn under negative pressure into an air pollution control system which may include a variety of units depending on the contaminants and site-specific requirements.

Ex situ on-site incineration is a demonstrated treatment technology for PCB-contaminated soils. Incineration is considered an effective technology, achieving a greater than 99% reduction requirement of PCBs and dioxins concentrations in soil, thus providing long-term protection. However, similar to thermal desorption, incineration does not treat heavy metals, and as a result, residual ash may need to be stabilized and disposed of at an appropriate facility. Additionally, incinerators burning hazardous wastes must meet the RCRA incinerator regulations (40 CFR Parts 264 and 265, Subpart O) as well as state and local regulations. Furthermore, on-site incinerators used to treat PCB-contaminated material with concentrations greater than 50 mg/kg may also be subject to the requirements under the Toxic Substances Control Act (TSCA) set forth in 40 CFR Part 761.

- **Effectiveness.** Incineration is an effective, demonstrated technology that can treat PCB-contaminated soils. Incineration does not treat most heavy metals, which would produce a residual ash that may need to be stabilized. Other volatile heavy metals such as lead, cadmium, mercury, and arsenic may leave the combustion unit with the flue gases and require additional gas cleaning systems for removal. Potentially, metals may react with elements in the waste feed, resulting in the formation of more toxic and volatile compounds.

- **Implementability.** Similar to other ex situ technologies, an on-site incineration plant would need to be constructed to implement this treatment. Due to a lack of available space on the commercial property sites, this technology would not be easily implemented.

- **Cost.** Ex situ incineration is a high cost technology with costs ranging from $600 to $1,100 per CY (FRTR 2002).

In summary, the effectiveness of incineration to remediate site contaminated soils would be similar to HTTD, however, at much higher costs and with additional risks regarding the treatment of metals in the waste feed. Similar to HTTD, this technology would not be easily implemented at the site due to space limitations. Therefore, incineration will not be retained for further consideration.

Ex Situ Vitrification

Thermal vitrification of contaminated material uses a natural gas and oxygen-enhanced power source or an electrical power source to treat PCB-impacted soil and produce a glass-like material. Natural gas-fired vitrification is less costly than the electric-powered system. For thermal vitrification, soils must be excavated, segregated, and stockpiled prior to treatment in an on-site glass furnace. This alternative may require the soils to be “dried” so that the soils entering the system contain less than 15% moisture.

The glass furnace is a "melter" constructed of refractory brick. A series of oxy-fuel burners combine natural gas and oxygen, which raise the temperature of the melter to 2,900°F. PCBs are destroyed and the soil melts and flows out of the system as molten glass. Molten glass then flows into a water-filled quench tank that hardens the molten glass into glass aggregate that makes it inert to the environment, trapping any heavy metals or other contaminants not destroyed by the high temperatures. Water is continuously added to the quench tank as the molten glass causes the water to evaporate. The glass aggregate can be beneficially reused as backfill in the original excavation, or it can be sold for use as a loose-grain abrasive, as highway aggregate, or any number of other applications.

A pilot-scale ex situ vitrification process using glass furnace technology was demonstrated to treat PCB-contaminated river sediment at Minergy Glass Pack Test Center, Wisconsin and is documented in the EPA's SITE Program in *Minergy Corporation Glass Furnace Technology Evaluation* (EPA 2004). The process attained greater than 99% total PCBs removal or destruction, and the glass aggregate met the state of Wisconsin's requirements for beneficial reuse. Other vitrification technologies that historically converted waste materials to glass aggregate have been applied in NYS, and the resulting materials met the NYSDEC Beneficial Use Determination (BUD) requirements.

- **Effectiveness.** Ex situ vitrification of soils is an effective method of treating PCB-contaminated soils. In addition, this technology is also effective for heavy metals, as it reduces mobility and eliminates the potential for leaching into groundwater.

- **Implementability.** Contractors are available to implement this technology. However, since there are currently no commercial vitrification plants accepting waste, a system would need to be constructed at or near the site. Due to space restrictions at the terrestrial properties, this system would need to be constructed at an off-site location and contaminated soils would need to be transported to it. A bench-scale study would be necessary prior to implementation of this technology.

- **Cost.** Estimated costs for ex situ vitrification obtained from Minergy range from $50 to $475 per CY (Minergy Corporation 2007 and 2003). Compared with other ex situ treatment technologies, ex situ vitrification has a much greater up-front capital cost for construction of an on-site plant. There are some financial risks associated with this technology as a major cost-factor is the price of natural gas, which can fluctuate significantly over the life of the operation.

In summary, ex situ vitrification has been shown to be effective in remediating PCB and metals contamination. However, due to implementability constraints and relatively high costs for construction of a vitrification facility, this technology will not be retained for further consideration.

3.3.2.5.2 Physical/Chemical Treatment

Several ex situ physical/chemical treatment processes for soils have been developed to chemically convert, separate, or contain waste constituents. These include dehalogenation (or dechlorination), soil washing, solvent extraction, and solidification/stabilization as discussed below.

Dehalogenation

Dehalogenation is a chemical process that is achieved either by replacement of the halogen molecule of the organic compound or decomposition and partial volatilization of the contaminant through adding and mixing specific reagents. This technology typically consists of excavating, screening, and crushing the contaminated soils, mixing the soils with the reagent in a heated reactor, and then treating the wastewater or the volatilized contaminants. This process has been successfully used and demonstrated for cleanup of contaminated soils containing PCBs ranging between 2 and 45,000 mg/kg. However, it has not been shown to be effective in treating heavy metals.

- **Effectiveness.** This technology has been approved by EPA's Office of Toxic Substances under TSCA for PCB treatment, and has been selected for cleanup at three Superfund sites. It has not been shown to be effective for remediation soils contaminated with metals.

- **Implementability.** EPA has been developing Base Catalyzed Decomposition (BCD) technology since 1990, in cooperation with the Naval Facilities Engineering Service Center (NFESC) (NFESC 1998), as a remedial technology specifically for soils contaminated with chlorinated organic compounds such as PCBs. Although this technology has been approved by EPA's Office of Toxic Substances under TSCA for PCB treatment, and one successful test run in 1994 was completed, BCD has had no commercial application to date.

- **Cost.** Ex situ dehalogenation is a high-cost technology with costs ranging from $440 to $1,100 per CY (FRTR 2002). Excavation and material handling costs would be higher with this alternative compared with more established technologies.

In summary, since dehalogenation has not been commercially implemented on a large scale, is expensive, and is not effective in treating soils contaminated with metals. Therefore, this technology will not be retained for further consideration.

Solvent Extraction

Solvent extraction is a chemical process whereby the target contaminant is physically separated from its medium (soil) using an appropriate organic solvent. This technology does not destroy the waste, but reduces the volume of material that must be treated. Solvent extraction is typically accomplished by homogeneously mixing the soil, flooding it with the solvent, then mixing thoroughly again to allow the waste to come in contact with the solution. Once mixing is complete, the solvent is drawn off by gravity, vacuum filtration, or some other conventional dewatering process. The solids are then rinsed with a neutralizing agent (if needed), dried, and placed back on site or otherwise treated/disposed of. Solvents and rinse water are processed through an on-site treatment system and recycled for further use. Solvent extraction has been shown to be effective in treating sediments, sludges, and soils containing primarily organic contaminants such as PCBs, VOCs, halogenated solvents, and petroleum wastes. Additionally, use of acid solvents can be effective in treating metals contamination.

- **Effectiveness.** An on-site demonstration of the solvent extraction technology was completed in 2000 at a similar site contaminated with PCBs. Although analytical results from the demonstration showed, on average, a greater than 99% total PCB removal, operational problems were encountered during start-up, and multiple extractions were needed to achieve the required cleanup criteria. Extraction using acid as a solvent has been shown to be effective for removing metals.

- **Implementability.** This technology was demonstrated successfully at a number of Superfund sites for PCB-contaminated soils and sediment as well as at sites containing metals contaminated material. However, full-scale application of the technology has been limited, especially with large volumes of soil. Since multiple extractions would need to be performed in succession with different solvents in order to remove both the inorganic and organic contaminants, interactions between solvents may present problems. Additional concerns with this technology include the potential for the presence of solvent in the treated soil, and regeneration and reuse of the spent solvent.

- **Cost.** The costs involved in the implementation of this technology would typically range between $275 to $1,300 per CY depending on site-specific conditions and volume of treated material (FRTR 2002).

In summary, solvent extraction has not been commercially implemented and is costly compared to other ex situ treatment technologies. Furthermore, multiple extractions would need to be performed with different solvents to remove both PCBs and metals. For these reasons, solvent extraction is not being retained for further consideration.

Soil Washing

Soil washing segregates the fine solid fractions from the coarser soils through an aqueous washing process and uses a wash-water treatment system. Typically, soil washing has been used to remediate SVOCs, fuels, and heavy metals in soils, with limited success in remediating PCB-contaminated soils. This technology is based on the observation that the majority of contaminants are found adsorbed into the fine soils (typically silt and clay-size particles) due to their greater specific surface area. The finer, contaminated fraction of soils would require further treatment/

disposal. The coarser soils (expected to be relatively free of contamination) would be backfilled on site once site cleanup goals have been achieved, which might require the soil to pass through the soil washing process multiple times. This alternative, on average, returns 80 to 90% of the treated soil or sediment back to its source. Commercially available surfactants are commonly used in the aqueous washing solution to transfer contaminants from the soil matrix to the liquid phase. Bench-scale studies are generally required prior to implementation of a full-scale soil washing operation to determine site-specific parameters and selection of surfactant(s).

- **Effectiveness.** Soil washing offers the ability to clean a wide range of contaminants from coarse-grained soils. However, the effectiveness of the technology decreases with complex waste mixtures similar to the heterogenous fill material at the three terrestrial properties, which make selection of the washing fluid complicated. Soil washing has had only limited success for remediating PCBs.

- **Implementability.** Bench-scale studies are generally required prior to implementation of a full-scale soil washing operation to determine site-specific parameters and selection of surfactant(s). The equipment for this process would be fairly inexpensive, readily available, and mobile. However, due to space constraints, a soil-washing treatment system would not be easily constructed on site.

- **Cost.** Ex situ soil washing is a moderate cost technology with costs ranging between $333 to $444 per CY depending on the site conditions, target waste quantity, and concentration (FRTR 2002).

In summary, there is not a high degree of confidence in the effectiveness of soil washing of PCB contaminated soil. Furthermore, the heterogeneous nature of the material and type of contamination found at these sites might require multiple washing procedures with various surfactants, thereby complicating the procedure and increasing costs. Implementability at the site may prove challenging due to space limitations. Therefore, although cost effective, ex situ soil washing will not be retained for further consideration.

Ex Situ Solidification/Stabilization

Ex situ solidification and stabilization methods are used to reduce the mobility of contaminants by physically (solidification) or chemically (stabilization) binding them to their native media. These treatments are identical to the in situ versions discussed earlier, with the exception that material is excavated before treatment. Once excavated and treated, contaminated material generally needs to be disposed of at an approved facility, but in some cases may be suitable for use as site backfill.

There are many different solidification and stabilization processes, which can be used to immobilize a variety of inorganic contaminants. Some examples include bituminization, emulsified asphalt, and Portland cement processes. Each of these processes has been shown to effectively capture inorganic contaminants, thereby reducing their mobility. However, these processes are not effective in treating organic compounds such as PCBs.

- **Effectiveness.** Ex situ solidification/stabilization processes are effective in treating inorganics (i.e., heavy metals) and radionuclides. These processes do not reduce the mobility or destroy organic compounds such as PCBs.

- **Implementability.** Treatability studies would be required to assess compatibility of waste material and the type of process used. Additional treatment technologies would need to be applied in succession in order to remediate PCBs in the contaminated soils.

- **Cost.** Ex situ solidification/stabilization processes cost around \$100 to \$200 per CY depending on the size of the site, the nature of the contaminated material, and the type of process used (FRTR 2002). Additionally, since this is an ex situ type of treatment, excavation costs will need to be included. Finally, if the treated material is unsuitable for use as site backfill, disposal costs will also apply. These costs may be significantly higher due to the increase in volume that results from solidification/stabilization treatment.

Since ex situ solidification and stabilization technologies are not effective in immobilizing or removing PCBs, additional treatment technologies would need to be applied in succession in order to reduce the potential for harm to human health and the environment. This would result in much higher costs than other available technologies as well as many uncertainties regarding treatment effectiveness for site COCs. Therefore, ex situ solidification and stabilization methods will not be retained for further analysis.

3.3.2.6 On- and Off-site Disposal
Land disposal of contaminated wastes has historically been the most common remedial action for hazardous waste sites. The two available disposal options are: on-site disposal in a constructed landfill, or off-site disposal in a commercial facility.

3.3.2.6.1 On-site Disposal
On-site disposal of contaminated material would involve construction of a landfill at one or more of the OUs. Since there is no available space at these properties for construction of a landfill, on-site disposal is not feasible and will not be further considered.

3.3.2.6.2 Off-site Disposal

Off-site disposal of contaminated soils involves hauling excavated materials to an appropriate commercially licensed disposal facility. The type of disposal facility selected depends on whether the waste is considered hazardous or non-hazardous. Waste material classified as hazardous waste may only be disposed of in an RCRA-permitted facility. In accordance with New York State Hazardous Waste Regulations and TSCA, materials containing PCBs at or above 50 ppm (if excavated and removed from the site), are subject to regulation as both hazardous waste and TSCA waste. Contaminated materials that exhibit characteristics of hazardous waste as defined in 40 CFR 261 and tested via TCLP are also subject to hazardous waste regulations. Materials not considered hazardous can be disposed of in a non-hazardous/solid waste facility.

- **Effectiveness.** Excavation and disposal of contaminated soil at a permitted landfill is an effective method of reducing potential for direct contact with contaminated soils. In addition, this action reduces the potential for future contamination of groundwater.

- **Implementability.** Contractors and disposal facilities are available to implement both disposal options.

- **Cost.** The cost for disposal of contaminated soils is approximated at less than $100 per CY for non-hazardous soils and $200 per CY for hazardous soils (Waste Management 2008).

In summary, disposal of contaminated materials in an off-site permitted disposal facility is a demonstrated alternative, which effectively reduces exposure risks and provides long-term protection of human health and the environment. For these reasons, off-site disposal will be retained as an applicable alternative.

3.4 Identification of Alternatives

This section identifies alternatives based on the technologies presented in Section 3.3. In collaboration with NYSDEC, four alternatives were identified for the soil contamination at the terrestrial properties: OU-3: Former United Paperboard Company; OU-4: Upson Park; and OU-5: White Transportation. The remedial alternatives at the Former Flintkote Plant site were considered when developing the alternatives for these OUs. A detailed description and evaluation of the alternatives is presented in Section 3.5.

3.4.1 Alternative No. 1: No Action

The no-action alternative was carried through the FS for comparison purposes as required by the NCP. This alternative would be acceptable only if it is demonstrated that the contamination at the site is below the RAOs, or that natural processes will reduce the contamination to acceptable levels. This alternative does not include ICs.

3.4.2 Alternative No. 2: Institutional Controls, Bank Stabilization, and Long-term Monitoring

The ICs alternative will consist of access/use and environmental easements at the properties to limit the potential for human exposure to contaminated site soils. Fencing and signage will be used as a physical barrier and as a warning to further restrict human contact with site soils. Bank stabilization will be implemented to limit erosion of upland soils to the creek. This will reduce the risk of recontaminating creek sediments. LTM will be performed to assess whether contaminated soils are migrating to Eighteenmile Creek.

3.4.3 Alternative No. 3: Limited Excavation and Off-site Disposal, Containment in Areas With COCs Exceeding Commercial Use SCOs, Bank Stabilization, Institutional Controls, and Long-term Monitoring

This alternative consists of limited excavation of soils that exceed SCOs and are considered hazardous and containment (in-place) of soils that exceed SCOs but are considered non-hazardous. In addition, some material that is considered non-hazardous will be excavated as stability of a cover on steep slopes may not be effective in the long-term. Excavated hazardous material will be transported off site and properly disposed at an RCRA approved hazardous waste disposal facility. The remaining areas with soils exceeding SCOs will be contained in place by a cover system to reduce exposure to contaminated soils. Bank stabilization measures will be implemented to limit erosion of upland soils to the creek. This will reduce the risk of recontaminating creek sediments. Since material with contaminant concentrations above commercial cleanup goals will remain on site, ICs, such as environmental easements, will need to be implemented to limit the future risk to property owners, workers, and visitors. LTM will be performed to assess whether contaminated soils are migrating to Eighteenmile Creek.

3.4.4 Alternative No. 4: Complete Excavation and Off-site Disposal, Bank Stabilization, and Long-term Monitoring

This alternative consists of complete excavation of on-site soils exceeding SCOs. Contaminated soils will be disposed off site in appropriate disposal facilities. As in Alternative 3, handling and disposal of hazardous material will be performed according to RCRA regulations. Non-hazardous soils will be segregated from hazardous soils and disposed of in an approved disposal facility. Bank stabilization measures and LTM will be implemented similar to the methods described in Alternatives 2 and 3.

3.4.5 Alternative No. 5: Limited Excavation and Off-site Disposal, Complete Containment, Bank Stabilization, and Long-term Monitoring

This alternative is similar to Alternative 3, with the exception that all material not excavated will be covered in place. This includes material detected above commercial SCOs, as well as all other exposed soil and fill material. Excavation, disposal, containment, bank stabilization, and long term monitoring would be performed as described in Alternatives 2 and 3.

3.4.6 Alternative No. 6: Complete Excavation and Off-site Disposal of Material with COCs Exceeding Unrestricted Use SCOs and Bank Stabilization

This alternative would be similar to Alternative 4, with the exception that all material exceeding unrestricted use SCOs would be excavated and disposed off-site. This alternative is included to satisfy the requirements of 6 NYCRR Part 375 to consider unrestricted use SCOs for remediating sites to pre-disposal conditions, to the extent feasible. Excavation and off-site disposal would be performed as described in Alternative 4. Since all material exceeding unrestricted use SCOs would be removed, long-term monitoring would not be required. However, it is assumed that bank stabilization measures would be implemented to protect newly constructed creek banks from erosion.

3.5 Detailed Analysis of Alternatives

3.5.1 Introduction

The purpose of the detailed analysis of remedial action alternatives is to present the relevant information for selecting a remedy for the site. In the detailed analysis, the alternatives established in Section 3.4 are described in detail and evaluated on the basis of environmental benefits and costs using criteria established by NYSDEC in TAGM 4030, Draft DER-10, and 6 NYCRR Part 375. This approach is also intended to provide the necessary information to compare the merits of each alternative and select an appropriate remedy that satisfies the RAOs for the site.

3.5.2 Detailed Evaluation of Criteria

This section first presents a summary of ten evaluation criteria that were used to evaluate the alternatives.

Overall Protection of Human Health and the Environment

This criterion provides an overall check on whether the alternative protects human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria, especially long-term effectiveness, short-term effectiveness, and compliance with SCGs.

Compliance with SCGs

This criterion evaluates compliance with SCGs that apply to this site. Standards are promulgated levels that apply directly to the media of interest and are required to be met. Criteria and guidance levels are non-promulgated levels that may be applicable and are TBC. Attainment of criteria and guidance is not legally required.

SCGs include chemical-specific values that address concentrations of contaminants in various media; action-specific requirements, such as requirements for handling hazardous waste, and location-specific requirements, such as wetlands regulations. The proposed cleanup goals were developed based on SCGs presented in Section 3.2.3.1.

Short-term Impacts and Effectiveness
This criterion assesses the effects of the alternative during the construction and implementation phase until remedial objectives are met, including protection of the community during the action and the time required to complete the response.

Long-term Effectiveness and Permanence
This criterion evaluates the permanence of the remedial alternative, the magnitude of the remaining risk, and the adequacy and reliability of the controls on any remaining contamination.

Reduction of Toxicity, Mobility, and Volume through Treatment
This criterion addresses NYSDEC's preference for selecting "remedial technologies that permanently and significantly reduce the toxicity, mobility, and volume" of the COCs at the site. This evaluation consists of assessing the extent to which the treatment technology destroys toxic contaminants, reduces mobility of the contaminants using irreversible treatment processes, and/or reduces the total volume of contaminated media.

Implementability
This criterion assesses the technical and administrative feasibility of implementing an alternative and the availability of various services required for the alternative's implementation.

Cost
The estimated capital costs, long-term O&M costs, and environmental monitoring costs are evaluated. The estimates included herein (unless otherwise noted) assume engineering and administrative costs would equal 10% of the capital costs and contingency costs would equal 25% of the capital costs. A present-worth analysis is made to compare the remedial alternatives on the basis of a single dollar amount for the base year. For the present-worth analysis, assumptions are made regarding the interest rate applicable to borrowed funds and the average inflation rate. Based on *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008, an annual discount rate of 2.7% was assumed for this analysis. Also, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* states that, in general, the period of performance for costing purposes should not exceed 30 years for this analysis. Therefore, the following detailed analysis of remedial alternatives will follow this guidance. The comparative cost estimates are intended to reflect actual costs with an accuracy of +50% to –30%.

State Acceptance

This assessment evaluates the technical and administrative issues and concerns the state may have regarding each alternative. This criterion will be addressed in the ROD once comments are received on the proposed plan. Therefore, no further discussion of this topic will be included in each alternative evaluation.

Community Acceptance

Community acceptance will be addressed during the PRAP public comment period prior to formalization of the ROD. Therefore, no further discussion of this topic will be included in each alternative evaluation.

Land Use

The land use criterion evaluates the issues and concerns regarding the current, intended, and reasonably anticipated future land uses of the site. Other considerations include the sites' surroundings, compatibility with applicable zoning laws, compatibility with comprehensive community master plans, such as Local Waterfront Revitalization plans, proximity to incompatible properties near the site, accessibility to existing infrastructure, and a number of other concerns as identified in 6 NYCRR Part 375-1.

A detailed description of the alternatives listed in Section 3.4 and evaluation criteria are described below. Cost estimates for each alternative are presented in Tables 3-7 through 3-11. Table 3-12 presents a summary of these costs.

3.5.3 Remedial Alternatives

3.5.3.1 Alternative No. 1: No Action

3.5.3.1.1 Description

The No Action Alternative involves taking no further action to remedy site conditions. The NCP at 40 CFR §300.430(e) (6) provides that the No Action Alternative be considered at every site as a baseline for comparison with other alternatives. This alternative does not include remedial action, institutional or engineering controls, or LTM.

3.5.3.1.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is not protective of human health and the environment because the site would remain in its present condition. Soils exceeding target risk levels and regulatory levels will continue to exist at the site and will be available for potential future exposure to human and ecological receptors. Direct contact and ingestion of contaminated soils may pose a risk to visitors, angler, site workers, and wildlife. Furthermore, the No Action Alternative does not address transport mechanisms, such as erosion, that would allow OU soils to continue to be a potential source of contamination to Eighteenmile Creek.

Table 3-7 Cost Estimate, Alternative 2 - Institutional Controls, Bank Stabilization, and Long-term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$10,000	$10,000
Institutional Controls	Environmental Easements	1	LS	$20,000	$20,000
Site Preparation					
Mobilization / Demobilization		1	LS	$25,000	$25,000
Fencing	Chain link industrial, 6' High, 6 gauge wire with 3 strands barb wire	8,400	LF	$30.50	$256,200
Signage	Reflectorized 24"x24" sign mounted to fence	5	EA	$108.00	$600
Site Clearing					
Cut and chip heavy trees	For access roads and staging area	1	Acre	$12,300	$11,400
Grub stumps and remove - heavy	For access roads and staging area	1	Acre	$6,525	$6,100
Staging Area and Access Road Construction					
Access Road Grading		1,556	SY	$1.40	$2,200
Access Road Construction	8" gravel fill; incl labor + materials	1,556	SY	$14.75	$23,000
Staging Area Construction	8" gravel fill and liner; incl labor + materials	3,472	SY	$14.75	$51,300
Front End Loader	To manage material; assume 100% of project duration	130	Day	$729.84	$94,900
Bank Stabilization (Along Access Roads Constructed Along the Creek as Part of OU-1; See Section 2)					
Topsoil (Material)	3" layer, 20' width, along the length of the creek, both banks	1,917	LCY	$16.25	$31,200
Haul Topsoil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,917	LCY	$24.00	$46,000
Spread Topsoil	Spread dumped material, no compaction	1,917	LCY	$1.85	$3,600
Compact Topsoil	12" lifts, vibrating roller	1,667	ECY	$2.82	$4,700
Jute Mesh (Erosion Control Mat)		10,000	SY	$1.60	$16,000
Hydroseeding large areas		10,000	SY	$0.39	$3,900
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI)	36	Ea	$162.00	$5,800
Plantings (Shrubs)		104	Ea	$81.00	$8,500
Removal of Staging Area and Access Roads					
Excavate Gravel Access Roads	Hydraulic Excavator, 1 CY bucket	1,117	BCY	$14.65	$16,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Modern Landfill in Lewiston, NY	1,676	Ton	$13.00	$21,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	1,676	Ton	$26.00	$43,600
Topsoil (Material)	For access roads and staging areas; assume 8" of material	1,285	LCY	$16.25	$20,900
Haul Topsoil		1,285	LCY	$24.00	$30,900
Spread Topsoil	Spread dumped material, no compaction; incl cut-back volume	1,285	LCY	$1.85	$2,400
Compact Topsoil	12" lifts, vibrating roller; incl cut-back volume	1,117	ECY	$2.82	$3,200
Finish grading, large area	Steep slopes	45	MSF	$22.50	$1,100
Hydroseeding large areas		5,028	SY	$0.39	$2,000
		Capital Cost Subtotal:			$762,700
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$755,836
	25% Legal, administrative, engineering fees, construction management:				$189,000
	25% Contingencies:				$236,300
	Capital Cost Total:				**$1,181,200**
	Capital Cost Total (2009 Dollars):				**$1,218,000**
Annual Costs					
Site Monitoring	Visual survey of bank stabilization measures, etc., assume 2 persons @ $100/hr; 10 hr/day for 2 events	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
		Annual Cost Subtotal:			$6,000
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$6,000
	10% Legal and Administrative Fees:				$600
	25% Contingencies:				$1,700
	Annual Cost Total:				**$8,300**
	30-year Present Worth of Annual Costs:				**$169,200**
	30-year Present Worth of Annual Costs (2009 Dollars):				**$175,000**

Table 3-7 Cost Estimate, Alternative 2 - Institutional Controls, Bank Stabilization, and Long-term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$6,000	$6,000
Fence Maintenance	Assume 5% of fence replaced	420	LF	$30.50	$12,900
Institutional Controls	Maintain / Update Documentation	1	LS	$5,000	$5,000
				Periodic Cost Subtotal:	$31,900
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$31,700
				10% Legal and Administrative Fees:	$3,200
				25% Contingencies:	$8,800
				Periodic Cost Total:	**$43,700**
				30-year Present Worth of Periodic Costs:	**$211,400**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$218,000**
				2009 Total Present Worth Cost:	**$1,611,000**

Notes:

1. Assume 4 access roads, as shown on Figure 3-3.

Length Access Road 1	75	ft		
Length Access Road 2	125	ft		
Length Access Road 3	250	ft		
Length Access Road 4	250	ft		
Access road width (assumed):	20	ft		
TOTAL ACCESS ROAD AREA:	14,000	SF, or	1,556	SY

2. Assume access roads will consist of 8" of gravel. For restoration, will be replaced by 8" of topsoil and seeded. Assume access roads 1 through 3 will need to be cleared and grubbed. Access Road 4 will not need to be cleared because it takes advantage of an existing dirt parking lot.

TOTAL ACCESS ROAD AREA REQUIRING CLEARING: 9,000 SF 1000 SY

3. Assume the following number of staging areas. 1

Each staging area is approx: 250 ft by 125 ft

31,250 SF, or 0.7 acres

4. Estimated Length of Creek adjacent to properties 4,500 LF

5. Estimated Perimeter of Contaminated Areas (for Fencing) 8,400 LF

6. Construction Duration (Assuming 5 day work week) 6 mo

7. Conversion from BCY to LCY (dewatered material): 1.15 LCY/BCY

8. Conversion from BCY to tons (dewatered material): 1.5 tons/BCY

9. Conversion from BCY to LCY (saturated material): 1.12 LCY/BCY

10. Conversion from BCY to tons (saturated material): 1.7 tons/BCY

11. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the

12. Costs presented are based on conventional contracting methods.

13. Assume tree and shrub planting grid spacing every 25 ft

14. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Key:

BCY = Bank cubic yards.
CY = Cubic Yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards.
LF = Linear feet.
LS = Lump sum.
Mo = Month
MSF = 1000 square feet.
OU = Operable Unit.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 3-8 Cost Estimate, Alternative 3 - Limited Excavation, Offsite Disposal, Containment of Areas with COCs Exceeding Commercial Use SCOs, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Institutional Controls	Environmental Easements	1	LS	$20,000	$20,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$200,000	$200,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	260	Day	$800	$208,000
Community Air Monitoring	Particulate meters	6	Ea	$7,555	$45,400
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	4	Setups	$3,000	$12,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	130	Day	$1,600	$208,000
Traffic Control (Labor)	For roads adjacent to the commercial properties, including Clinton St, Mill St, and Water St. Assume 1 person for 50% of project duration	130	Day	$600	$78,000
Fencing	Chain link fence rental, 6' high, around perimeter of sites	5,125	LF	$10.20	$52,300
Site Clearing of Excavation Areas, Cover Areas, and Access Roads					
Cut and chip heavy trees	Large trees and dense vegetation along creek banks and at excavation / cover areas	2	Acre	$12,300	$21,000
Grub stumps and remove - heavy	Along creek banks and at excavation / cover areas	2	Acre	$6,525	$11,200
Staging Area and Access Road Construction					
Access Road Grading		1,556	SY	$1.40	$2,200
Access Road Construction	8" gravel fill; incl labor + materials	1,556	SY	$14.75	$23,000
Staging Area Construction	8" gravel fill and liner; incl labor + materials	3,472	SY	$14.75	$51,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	260	Day	$730	$189,800
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr; incl contaminated soil and cutback volume	5,200	BCY	$1.54	$8,100
Material Transportation On-site (from excavations to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	5,980	LCY	$3.73	$22,400
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	60	EA	$300	$18,000
Disposal Sampling	PCBs, metals, and TCLP metals analysis	9	EA	$510	$4,600
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	7,350	Ton	$25.00	$183,800
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	7,350	Ton	$165	$1,212,800
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	600	Ton	$13.00	$7,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	600	Ton	$26.00	$15,600
Backfill and Site Restoration (of Excavated Area)					
Fill (Material incl. 6" of top soil at surface)		5,980	LCY	$16.25	$97,200
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	5,980	LCY	$24.00	$143,600
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	5,980	LCY	$1.85	$11,100
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	5,200	ECY	$2.82	$14,700
Finish grading, large area	Steep slopes	37	MSF	$22.50	$900
Hydroseeding large areas		4,100	SY	$0.39	$1,600
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI)	59	Ea	$162.00	$9,600
Bank Stabilization (Along Access Roads Constructed Along the Creek as Part of OU-1 [excluding containment areas]; See Section 2)					
Topsoil (Material)	3" layer, 20' width, along the length of the creek, both banks except over containment areas	739	LCY	$16.25	$12,100
Haul Topsoil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	739	LCY	$24.00	$17,800
Spread Topsoil	Spread dumped material, no compaction	739	LCY	$1.85	$1,400
Compact Topsoil	12" lifts, vibrating roller	643	ECY	$2.82	$1,900
Jute Mesh (Erosion Control Mat)		8,867	SY	$1.60	$14,200
Hydroseeding large areas		8,867	SY	$0.39	$3,500
Plantings (Trees)	Costs for planting of trees along banks included in Backfill and Site Restoration	0	Ea	$162.00	$0
Plantings (Shrubs)		128	Ea	$81.00	$10,400
Removal of Staging Area and Access Roads					
Excavate Gravel Staging Area and Access Roads	Hydraulic Excavator, 1 CY bucket	1,117	BCY	$14.65	$16,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	1,676	Ton	$13.00	$21,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	1,676	Ton	$26.00	$43,600
Topsoil (Material)	For access roads and staging area; assume 8" of material	1,285	LCY	$16.25	$20,900
Haul Topsoil		1,285	LCY	$24.00	$30,900
Spread Topsoil	Spread dumped material, no compaction	1,285	LCY	$1.85	$2,400
Compact Topsoil	12" lifts, vibrating roller	1,117	ECY	$2.82	$3,200
Finish grading, large area	Steep slopes	45	MSF	$22.50	$1,100
Hydroseeding large areas		5,028	SY	$0.39	$2,000
Containment					
Geotextile Fabric		28,400	SY	$2.58	$73,300
High Visibility Demarcation Layer		28,400	SF	$0.30	$8,600

Table 3-8 Cost Estimate, Alternative 3 - Limited Excavation, Offsite Disposal, Containment of Areas with COCs Exceeding Commercial Use SCOs, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Clean soil	2' thick over areas of contamination not excavated, including 6" of topsoil for planting	2,419	LCY	$16.25	$39,400
Haul Soil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	2,419	LCY	$24.00	$58,100
Spread Soil	Spread dumped material, no compaction	2,419	LCY	$1.85	$4,500
Compact Soil	12" lifts, vibrating roller; incl cut-back volume	2,104	ECY	$2.82	$6,000
Finish grading, large area	Steep slopes	28	MSF	$22.50	$700
Hydroseeding large areas		3,156	SY	$0.39	$1,300
Geotextile Fabric	For additional protection along the creek banks at a width of 10'	567	SY	$2.58	$1,500
Clean stone	Assume 1' layer thick at a width of 10' over the geotextile fabric	189	LCY	$55.00	$10,400
				Capital Cost Subtotal:	$3,306,400
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$3,276,700
	25% Legal, administrative, engineering fees, construction management:				$819,200
				25% Contingencies:	$1,024,000
				Capital Cost Total:	**$5,119,900**
				Capital Cost Total (2009 Dollars):	**$5,276,000**
Annual Costs					
Site Monitoring	Visual survey of bank stabilization measures, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$6,000
				10% Legal and Administrative Fees:	$600
				25% Contingencies:	$1,700
				Annual Cost Total:	**$8,300**
				30-year Present Worth of Annual Costs:	**$169,200**
				30-year Present Worth of Annual Costs (2009 Dollars):	**$175,000**
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$5,700	$5,700
Cover Maintenance (replacing soil, geotextil	Assume 5% of initial cover cost	1	LS	$6,100	$6,100
Institutional Controls	Maintain / Update Documentation	1	LS	$5,000	$5,000
				Periodic Cost Subtotal:	$24,800
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$24,600
				10% Legal and Administrative Fees:	$2,500
				25% Contingencies:	$6,800
				Periodic Cost Total:	**$33,900**
				30-year Present Worth of Periodic Costs:	**$145,700**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$151,000**
				2009 Total Present Worth Cost:	**$5,602,000**

Notes:

1. Assume 4 access roads, as shown on Figure 3-4.

Length Access Road 1	75	ft			
Length Access Road 2	125	ft			
Length Access Road 3	250	ft			
Length Access Road 4	250	ft			
Access road width (assumed):	20	ft			
TOTAL ACCESS ROAD AREA:	14,000	SF, or	1556	SY	

2. Assume access roads 1, 2, and 3 will need clearing and grubbing; Access Road 4 will not need clearing or grubbing because it takes advantage of an existing dirt parking lot.

TOTAL ACCESS ROAD AREA REQUIRING CLEARING:	9,000	SF	500	SY	

3. Assume the following number of staging areas. 1

Each staging area is approx:	250	ft	by	125	ft
	31,250	SF, or	0.7	acres	

4. Estimated Volumes and Areas at Former United Paperboard Company

Volume of Hazardous Material	800	BCY
Volume of NonHazardous Material	3,800	BCY
Volume of NonHazardous Material (to be excavated)	300	BCY
Cutback Volume	0	BCY
Surface Area of Contaminated Material	21,300	SF
Surface Area of Cover Areas	6,900	SF
Length of Cover Areas along creek	200	LF

Table 3-8 Cost Estimate, Alternative 3 - Limited Excavation, Offsite Disposal, Containment of Areas with COCs Exceeding Commercial Use SCOs, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
5. Estimated Volumes and Areas at Upson Park					
Volume of Hazardous Material		4,100	BCY		
Volume of NonHazardous Material		2,100	BCY		
Cutback Volume		0	BCY		
Surface Area of Contaminated Material		43,000	SF		
Surface Area of Cover Areas		21,500	SF		
Length of Cover Areas along creek		250	LF		
6. Estimated Volumes and Areas at White Transportation					
Volume of Hazardous Material		0	BCY		
Volume of NonHazardous Material (to be excavated)		100	BCY		
Cutback Volume		0	BCY		
Surface Area of Contaminated Material		1,000	SF		
Surface Area of Cover Areas		0	SF		
Length of Cover Areas along creek		60	LF		
Estimated Total Surface Area of Cover		28,400	SF		
7. Estimated Total Site Perimeter (the 3 OUs)		5,125	LF		
8. Estimated Length of Creek adjacent to properties (includes both banks of creek)		4,500	LF		
9. Assume verification sampling grid spacing:		25	ft		
10. Construction Duration (Assuming 5 day work week)					
Total Project Time		12	mo		
		2	construction seasons, 6 months each		
11. Conversion from BCY to LCY (dewatered material):		1.15	LCY/BC		
12. Conversion from BCY to tons (dewatered material):		1.5	tons/BCY		
13. Conversion from BCY to LCY (saturated material):		1.12	LCY/BCY		
14. Conversion from BCY to tons (saturated material):		1.7	tons/BCY		

15. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).

16. Costs presented are based on conventional contracting methods.

17. Assume tree and shrub planting grid spacing every: 25 ft

18. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Key:
BCY = Bank cubic yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards
LF = Linear feet.
LS = Lump sum.
Mo = Month.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 3-9 Cost Estimate, Alternative 4 - Complete Excavation and Off-site Disposal, Bank Stabilization, and LTM, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$200,000	$200,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	260	Day	$800	$208,000
Community Air Monitoring	Particulate meters	6	Ea	$7,555	$45,400
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	4	Setups	$3,000	$12,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	130	Day	$1,600	$208,000
Traffic Control (Labor)	For roads adjacent to the commercial properties, including Clinton St, Mill St, and Water St. Assume 1 person for 50% of project duration	130	Day	$600	$78,000
Fencing	Chain link fence rental, 6' high, around perimeter of sites	5,125	LF	$10.20	$52,300
Site Clearing of Excavation Areas and Access Roads					
Cut and chip heavy trees	Large trees and dense vegetation at excavation areas	2	Acre	$12,300	$21,000
Grub stumps and remove - heavy	Along creek banks and at excavation areas	2	Acre	$6,525	$11,200
Staging Area and Access Road Construction					
Access Road Grading		1,556	SY	$1.40	$2,200
Access Road Construction	8" gravel fill; incl labor + materials	1,556	SY	$14.75	$23,000
Staging Area Construction	8" gravel fill and liner; incl labor + materials	3,472	SY	$14.75	$51,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	260	Day	$730	$189,800
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr; incl contaminated soil and cutback volume	10,900	BCY	$1.54	$16,800
Material Transportation On-site (from excavations to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	12,535	LCY	$3.73	$46,800
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	104	EA	$300	$31,400
Disposal Sampling	PCBs, metals, and TCLP metals analysis	17	EA	$510	$8,700
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	9,000	Ton	$13.00	$117,000
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	9,000	Ton	$26.00	$234,000
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	7,350	Ton	$25.00	$183,800
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	7,350	Ton	$165	$1,212,800
Backfill and Site Restoration (of Excavated Area)					
Fill (Material incl. 6" of top soil at surface)		12,535	LCY	$16.25	$203,700
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	12,535	LCY	$24.00	$300,900
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	12,535	LCY	$1.85	$23,200
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	10,900	ECY	$2.82	$30,800
Finish grading, large area	Steep slopes	65	MSF	$22.50	$1,500
Hydroseeding large areas		7,256	SY	$0.39	$2,900
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI)	104	Ea	$162	$17,000
Bank Stabilization (Along Access Roads Constructed Along the Creek as Part of OU-1; See Section 2)					
Topsoil (Material)	3" layer, 20' width, along the length of the creek, both banks	1,917	LCY	$16.25	$31,200
Haul Topsoil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,917	LCY	$24.00	$46,000
Spread Topsoil	Spread dumped material, no compaction	1,917	LCY	$1.85	$3,600
Compact Topsoil	12" lifts, vibrating roller	1,667	ECY	$2.82	$4,700
Jute Mesh (Erosion Control Mat)		10,000	SY	$1.60	$16,000
Hydroseeding large areas		10,000	SY	$0.39	$3,900
Plantings (Trees)	Costs for planting of trees along banks included in Backfill and Site Restoration	0	Ea	$162	$0
Plantings (Shrubs)		104	Ea	$81.00	$8,500
Removal of Staging Area and Access Roads					
Excavate Gravel Staging Area and Access Roads	Hydraulic Excavator, 1 CY bucket	1,117	BCY	$14.65	$16,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	1,676	Ton	$13.00	$21,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	1,676	Ton	$26.00	$43,600
Topsoil (Material)	For access roads and staging area; assume 8" of material	1,285	LCY	$16.25	$20,900
Haul Topsoil		1,285	LCY	$24.00	$30,900
Spread Topsoil	Spread dumped material, no compaction	1,285	LCY	$1.85	$2,400
Compact Topsoil	12" lifts, vibrating roller	1,117	ECY	$2.82	$3,200
Finish grading, large area	Steep slopes	45	MSF	$22.50	$1,100
Hydroseeding large areas		5,028	SY	$0.39	$2,000
				Capital Cost Subtotal:	$3,814,700

Table 3-9 Cost Estimate, Alternative 4 - Complete Excavation and Off-site Disposal, Bank Stabilization, and LTM, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$3,780,368
	25% Legal, administrative, engineering fees, construction management:				$945,100
	25% Contingencies:				$1,181,400
	Capital Cost Total:				**$5,906,900**
	Capital Cost Total (2009 Dollars):				**$6,087,000**
Annual Costs					
Site Monitoring	Visual survey of bank stabilization measures, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
	Annual Cost Subtotal:				$6,000
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$5,946
	10% Legal and Administrative Fees:				$600
	25% Contingencies:				$1,700
	Annual Cost Total:				**$8,300**
	30-year Present Worth of Annual Costs:				**$169,200**
	30-year Present Worth of Annual Costs (2009 Dollars):				**$175,000**
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$5,700	$5,700
	Periodic Cost Subtotal:				$13,700
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$13,577
	10% Legal and Administrative Fees:				$1,400
	25% Contingencies:				$3,800
	Periodic Cost Total:				**$18,800**
	30-year Present Worth of Periodic Costs:				**$91,000**
	30-year Present Worth of Periodic Costs (2009 Dollars):				**$94,000**
	2009 Total Present Worth Cost:				**$6,356,000**

Notes:

1. Assume 4 access roads, as shown on Figure 3-5

Length Access Road 1	75	ft		
Length Access Road 2	125	ft		
Length Access Road 3	250	ft		
Length Access Road 4	250	ft		
Access road width (assumed):	20	ft		
TOTAL ACCESS ROAD AREA:	14,000	SF, or	1,556	SY

2. Assume access roads 1, 2, and 3 will need clearing and grubbing; Access Road 4 will not need clearing or grubbing because it takes advantage of an existing dirt parking lot.

TOTAL ACCESS ROAD AREA REQUIRING CLEARING:	9,000	SF	500	SY

3. Assume the following number of staging areas.	1			
Each staging area is approx:	250	ft	125	ft
	31,250	SF, or	0.7	acres

Company

Volume of Hazardous Material	800	BCY
Volume of NonHazardous Material	3,800	BCY
Cutback Volume	0	BCY
Surface Area of Contaminated Material	21,300	SF
5. Estimated Volumes and Areas at Upson Park		
Volume of Hazardous Material	4,100	BCY
Volume of NonHazardous Material	2,100	BCY
Cutback Volume	0	BCY
Surface Area of Contaminated Material	43,000	SF
6. Estimated Volumes and Areas at White Transportation		
Volume of Hazardous Material	0	BCY
Volume of NonHazardous Material	100	BCY
Cutback Volume	0	BCY
Surface Area of Contaminated Material	1,000	SF
7. Estimated Total Site Perimeter (the 3 OUs)	5,125	LF
8. Estimated Length of Creek adjacent to properties (includes both banks of creek)	4,500	LF
9. Assume verification sampling grid spacing:	25	ft
10. Construction Duration (Assuming 5 day work week)		
Total Project Time	12	mo
	2	construction seasons, 6 months each
11. Conversion from BCY to LCY (dewatered material):	1.15	LCY/BCY
12. Conversion from BCY to tons (dewatered material):	1.5	tons/BCY
13. Conversion from BCY to LCY (saturated material):	1.12	LCY/BCY
14. Conversion from BCY to tons (saturated material):	1.7	tons/BCY

15. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).

16. Costs presented are based on conventional contracting methods.

17. Assume tree and shrub planting grid spacing every 25 ft

18. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Table 3-9 Cost Estimate, Alternative 4 - Complete Excavation and Off-site Disposal, Bank Stabilization, and LTM, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost

Key:

BCY = Bank cubic yards.

EA = Each.

ECY = Embankment cubic yards.

HR = Hour.

kGal = Thousand gallons.

LCY = Loose cubic yards

LF = Linear feet.

LS = Lump sum.

LTM = Long-term monitoring.

Mo = Month.

MSF = 1000 square feet.

OU = Operable Unit.

SF = Square feet.

SY = Square yards.

WWTP = Wastewater treatment plant.

Table 3-10 Cost Estimate, Alternative 5 - Limited Excavation, Offsite Disposal, Complete Containment, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Institutional Controls	Environmental Easements	1	LS	$20,000	$20,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$200,000	$200,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	260	Day	$800	$208,000
Community Air Monitoring	Particulate meters	6	Ea	$7,555	$45,400
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	4	Setups	$3,000	$12,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	130	Day	$1,600	$208,000
Traffic Control (Labor)	For roads adjacent to the commercial properties, including Clinton St, Mill St, and Water St. Assume 1 person for 50% of project duration	130	Day	$600	$78,000
Fencing	Chain link fence rental, 6' high, around perimeter of sites	5,125	LF	$10.20	$52,300
Site Clearing of Excavation Areas, Cover Areas, and Access Roads					
Cut and chip heavy trees	Large trees and dense vegetation along creek banks and at excavation / cover areas	9	Acre	$12,300	$111,000
Grub stumps and remove - heavy	Along creek banks and at excavation / cover areas	9	Acre	$6,525	$58,900
Staging Area and Access Road Construction					
Access Road Grading		1,556	SY	$1.40	$2,200
Access Road Construction	8" gravel fill; incl labor + materials	1,556	SY	$14.75	$23,000
Staging Area Construction	8" gravel fill and liner; incl labor + materials	3,472	SY	$14.75	$51,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	260	Day	$730	$189,800
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr; incl contaminated soil and cutback volume	5,200	BCY	$1.54	$8,100
Material Transportation On-site (from excavations to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	5,980	LCY	$3.73	$22,400
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	60	EA	$300	$18,000
Disposal Sampling	PCBs, metals, and TCLP metals analysis	9	EA	$510	$4,600
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	7,350	Ton	$25.00	$183,800
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	7,350	Ton	$165	$1,212,800
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	600	Ton	$13.00	$7,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	600	Ton	$26.00	$15,600
Backfill and Site Restoration (of Excavated Area)					
Fill (Material incl. 6" of top soil at surface)		5,980	LCY	$16.25	$97,200
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	5,980	LCY	$24.00	$143,600
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	5,980	LCY	$1.85	$11,100
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	5,200	ECY	$2.82	$14,700
Finish grading, large area	Steep slopes	37	MSF	$22.50	$900
Hydroseeding large areas		4,100	SY	$0.39	$1,600
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI)	59	Ea	$162.00	$9,600
Bank Stabilization (Along Access Roads Constructed Along the Creek as Part of OU-1 [excluding containment areas]; See Section 2)					
Topsoil (Material)	3" layer, 20' width, along the length of the creek, both banks except over containment areas	148	LCY	$16.25	$2,500
Haul Topsoil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	148	LCY	$24.00	$3,600
Spread Topsoil	Spread dumped material, no compaction	148	LCY	$1.85	$300
Compact Topsoil	12" lifts, vibrating roller	129	ECY	$2.82	$400
Jute Mesh (Erosion Control Mat)		1,778	SY	$1.60	$2,900
Hydroseeding large areas		1,778	SY	$0.39	$700
Plantings (Trees)	Costs for planting of trees along banks included in Backfill and Site Restoration	0	Ea	$162.00	$0
Plantings (Shrubs)		26	Ea	$81.00	$2,100
Removal of Staging Area and Access Roads					
Excavate Gravel Staging Area and Access Roads	Hydraulic Excavator, 1 CY bucket	1,117	BCY	$14.65	$16,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	1,676	Ton	$13.00	$21,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	1,676	Ton	$26.00	$43,600
Topsoil (Material)	For access roads and staging area; assume 8" of material	1,285	LCY	$16.25	$20,900
Haul Topsoil		1,285	LCY	$24.00	$30,900
Spread Topsoil	Spread dumped material, no compaction	1,285	LCY	$1.85	$2,400
Compact Topsoil	12" lifts, vibrating roller	1,117	ECY	$2.82	$3,200
Finish grading, large area	Steep slopes	45	MSF	$22.50	$1,100
Hydroseeding large areas		5,028	SY	$0.39	$2,000
Containment (Soil Cover)					
Geotextile Fabric		347,200	SY	$2.58	$895,800
High Visibility Demarcation Layer		347,200	SF	$0.30	$104,200

Table 3-10 Cost Estimate, Alternative 5 - Limited Excavation, Offsite Disposal, Complete Containment, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Clean soil	2' thick over areas of contamination not excavated, including 6" of topsoil for planting	29,576	LCY	$16.25	$480,600
Haul Soil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	29,576	LCY	$24.00	$709,900
Spread Soil	Spread dumped material, no compaction	29,576	LCY	$1.85	$54,800
Compact Soil	12" lifts, vibrating roller	25,719	ECY	$2.82	$72,600
Finish grading, large area	Steep slopes	347	MSF	$22.50	$7,900
Hydroseeding large areas		38,578	SY	$0.39	$15,100
Geotextile Fabric	For additional protection along the creek banks at a width of 10'	4,111	SY	$2.58	$10,700
Clean stone	Assume 1' layer thick at a width of 10' over the geotextile fabric	1,370	LCY	$55.00	$75,400
Containment (Asphalt Cover)					
Clean Soil	Assume 12"; needed to bring parking areas up to grade with surrounding soil covers, material only	2,815	LCY	$16.25	$45,737
Spread Soil	Spread dumped material, no compaction	2,815	LCY	$1.85	$5,207
Compact Soil	12" lifts, vibrating roller	2,448	ECY	$2.82	$6,902
Crushed Stone Base	Assume 1-1/2" stone, 8" thick, spread and compacted	2,815	SY	$15.90	$44,756
Binder Course	Assume 2-1/2" thick, includes material and labor	2,815	SY	$9.05	$25,474
Wearing Course	Assume 1-1/2" thick, includes material and labor	2,815	SY	$6.20	$17,452
Haul Material	12 CY dump truck, 20 miles round trip, 0.4 load/hr	5,630	LCY	$24.00	$135,111
				Capital Cost Subtotal:	$5,899,200
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$5,846,200
				25% Legal, administrative, engineering fees, construction management:	$1,461,600
				25% Contingencies:	$1,827,000
				Capital Cost Total:	**$9,134,800**
				Capital Cost Total (2009 Dollars):	**$9,414,000**
Annual Costs					
Site Monitoring	Visual survey of bank stabilization measures, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$6,000
				10% Legal and Administrative Fees:	$600
				25% Contingencies:	$1,700
				Annual Cost Total:	**$8,300**
				30-year Present Worth of Annual Costs:	**$169,200**
				30-year Present Worth of Annual Costs (2009 Dollars):	**$175,000**
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$5,700	$5,700
Cover Maintenance (replacing soil, geotextile, pavement)	Assume 5% of initial cover cost	1	LS	$85,400	$85,400
Institutional Controls	Maintain / Update Documentation	1	LS	$5,000	$5,000
				Periodic Cost Subtotal:	$104,100
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):	$103,200
				10% Legal and Administrative Fees:	$10,400
				25% Contingencies:	$28,400
				Periodic Cost Total:	**$142,000**
				30-year Present Worth of Periodic Costs:	**$610,200**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$629,000**
				2009 Total Present Worth Cost:	**$10,218,000**

Notes:

1. Assume 4 access roads, as shown on Figure 3-4.

Length Access Road 1	75	ft		
Length Access Road 2	125	ft		
Length Access Road 3	250	ft		
Length Access Road 4	250	ft		
Access road width (assumed):	20	ft		
TOTAL ACCESS ROAD AREA:	14,000	SF, or	1556	SY

2. Assume access roads 1, 2, and 3 will need clearing and grubbing; Access Road 4 will not need clearing or grubbing because it takes advantage of an existing dirt parking lot.

TOTAL ACCESS ROAD AREA REQUIRING CLEARING:	9,000	SF	500	SY

3. Assume the following number of staging areas. 1

Each staging area is approx:	250	ft	by	125	ft
	31,250	SF, or	0.7	acres	

Table 3-10 Cost Estimate, Alternative 5 - Limited Excavation, Offsite Disposal, Complete Containment, Bank Stabilization, Institutional Controls and Long Term Monitoring, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
4. Estimated Volumes and Areas at Former United Paperboard Company					
Volume of Hazardous Material		800	BCY		
Volume of NonHazardous Material		3,800	BCY		
Volume of NonHazardous Material (to be excavated)		300	BCY		
Cutback Volume		0	BCY		
Surface Area of Excavated Material		14,400	SF		
Surface Area of Soil Cover Areas		95,700	SF		
Length of Cover Areas along creek		1,900	LF		
Surface Area of Asphalt Cover Areas		30,000	SF		
5. Estimated Volumes and Areas at Upson Park					
Volume of Hazardous Material		4,100	BCY		
Volume of NonHazardous Material		2,100	BCY		
Cutback Volume		0	BCY		
Surface Area of Excavated Material		21,500	SF		
Surface Area of Soil Cover Areas		170,500	SF		
Length of Cover Areas along creek		1,300	LF		
Surface Area of Asphalt Cover Areas		46,000	SF		
6. Estimated Volumes and Areas at White Transportation					
Volume of Hazardous Material		0	BCY		
Volume of NonHazardous Material (to be excavated)		100	BCY		
Cutback Volume		0	BCY		
Surface Area of Excavated Material		1,000	SF		
Surface Area of Soil Cover Areas		81,000	SF		
Length of Cover Areas along creek		500	LF		
Surface Area of Asphalt Cover Areas		0	SF		
Estimated Total Surface Area of Soil Cover		347,200	SF		
Estimated Total Surface Area of Asphalt Cover		76,000	SF		
7. Estimated Total Site Perimeter (the 3 OUs)		5,125	LF		
8. Estimated Length of Creek adjacent to properties (includes both banks of creek)		4,500	LF		
9. Assume verification sampling grid spacing:		25	ft		
10. Construction Duration (Assuming 5 day work week)		2	construction seasons, 6 months each		
11. Conversion from BCY to LCY (dewatered material):		1.15	LCY/BCY		
12. Conversion from BCY to tons (dewatered material):		1.5	tons/BCY		
13. Conversion from BCY to LCY (saturated material):		1.12	LCY/BCY		
14. Conversion from BCY to tons (saturated material):		1.7	tons/BCY		

15. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).

16. Costs presented are based on conventional contracting methods.

17. Assume tree and shrub planting grid spacing every 25 ft

18. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Key:
BCY = Bank cubic yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards
LF = Linear feet.
LS = Lump sum.
Mo = Month.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 3-11 Cost Estimate, Alternative 6 - Complete Excavation and Off-site Disposal of Material With COCs Exceeding Unrestricted Use SCOs and Bank Stabilization, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$200,000	$200,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	823	Day	$800	$658,700
Community Air Monitoring	Particulate meters	6	Ea	$7,555	$45,400
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	4	Setups	$3,000	$12,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	412	Day	$1,600	$658,700
Traffic Control (Labor)	For roads adjacent to the commercial properties, including Clinton St, Mill St, and Water St. Assume 1 person for 50% of project duration	412	Day	$600	$247,000
Fencing	Chain link fence rental, 6' high, around perimeter of sites	5,125	LF	$10.20	$52,300
Site Clearing of Excavation Areas and Access Roads					
Cut and chip heavy trees	Large trees and dense vegetation at excavation areas	9	Acre	$12,300	$113,000
Grub stumps and remove - heavy	Along creek banks and at excavation areas	9	Acre	$6,525	$60,000
Staging Area and Access Road Construction					
Access Road Grading		1,556	SY	$1.40	$2,200
Access Road Construction	8" gravel fill; incl labor + materials	1,556	SY	$14.75	$23,000
Staging Area Construction	8" gravel fill and liner; incl labor + materials	3,472	SY	$14.75	$51,300
Front End Loader	To manage material at the staging area; assume 100% of project duration	823	Day	$730	$601,000
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr; incl contaminated soil and cutback volume	193,000	BCY	$1.54	$297,300
Material Transportation On-site (from excavations to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	221,950	LCY	$3.73	$827,900
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	626	EA	$300	$187,700
Disposal Sampling	PCBs, metals, and TCLP metals analysis	290	EA	$510	$147,900
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	282,150	Ton	$13.00	$3,668,000
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	282,150	Ton	$26.00	$7,335,900
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	7,350	Ton	$25.00	$183,800
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	7,350	Ton	$165	$1,212,800
Backfill and Site Restoration (of Excavated Area)					
Fill (Material incl. 6" of top soil at surface)		221,950	LCY	$16.25	$3,606,400
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	221,950	LCY	$24.00	$5,326,800
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	221,950	LCY	$1.85	$410,700
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	193,000	ECY	$2.82	$544,300
Finish grading, large area	Steep slopes	391	MSF	$22.50	$8,800
Hydroseeding large areas		43,444	SY	$0.39	$17,000
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI)	626	Ea	$162	$101,400
Bank Stabilization (Along Access Roads Constructed Along the Creek as Part of OU-1; See Section 2)					
Topsoil (Material)	3" layer, 20' width, along the length of the creek, both banks	1,917	LCY	$16.25	$31,200
Haul Topsoil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,917	LCY	$24.00	$46,000
Spread Topsoil	Spread dumped material, no compaction; incl cut-back volume	1,917	LCY	$1.85	$3,600
Compact Topsoil	12" lifts, vibrating roller; incl cut-back volume	1,667	ECY	$2.82	$4,700
Jute Mesh (Erosion Control Mat)		10,000	SY	$1.60	$16,000
Hydroseeding large areas		10,000	SY	$0.39	$3,900
Plantings (Trees)	Costs for planting of trees along banks included in Backfill and Site Restoration	0	Ea	$162	$0
Plantings (Shrubs)		626	Ea	$81.00	$50,700
Removal of Staging Area and Access Roads					
Excavate Gravel Staging Area and Access Roads	Hydraulic Excavator, 1 CY bucket	1,117	BCY	$14.65	$16,400
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	1,676	Ton	$13.00	$21,800
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	1,676	Ton	$26.00	$43,600
Topsoil (Material)	For access roads and staging area; assume 8" of material	1,285	LCY	$16.25	$20,900
Haul Topsoil		1,285	LCY	$24.00	$30,900
Spread Topsoil	Spread dumped material, no compaction; incl cut-back volume	1,285	LCY	$1.85	$2,400
Compact Topsoil	12" lifts, vibrating roller; incl cut-back volume	1,117	ECY	$2.82	$3,200
Finish grading, large area	Steep slopes	45	MSF	$22.50	$1,100
Hydroseeding large areas		5,028	SY	$0.39	$2,000

Table 3-11 Cost Estimate, Alternative 6 - Complete Excavation and Off-site Disposal of Material With COCs Exceeding Unrestricted Use SCOs and Bank Stabilization, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
				Capital Cost Subtotal:	$26,924,700
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$26,682,378
	25% Legal, administrative, engineering fees, construction management:				$6,670,600
				25% Contingencies:	$8,338,300
				Capital Cost Total:	**$41,691,300**
				Capital Cost Total (2009 Dollars):	**$42,963,000**
Annual Costs					
Site Monitoring	Visual survey of bank stabilization measures, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Evaluation and Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$5,946
				10% Legal and Administrative Fees:	$600
				25% Contingencies:	$1,700
				Annual Cost Total:	**$8,300**
				30-year Present Worth of Annual Costs:	**$169,200**
				30-year Present Worth of Annual Costs (2009 Dollars):	**$175,000**
Periodic Costs (Every 5 Years)					
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$7,900	$7,900
				Periodic Cost Subtotal:	$7,900
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$7,829
				10% Legal and Administrative Fees:	$800
				25% Contingencies:	$2,200
				Periodic Cost Total:	**$10,900**
				30-year Present Worth of Periodic Costs:	**$52,800**
				30-year Present Worth of Periodic Costs (2009 Dollars):	**$55,000**
				2009 Total Present Worth Cost:	**$43,193,000**

Notes:

1. Assume 4 access roads, as shown on Figure 3-5

Length Access Road 1	75	ft		
Length Access Road 2	125	ft		
Length Access Road 3	250	ft		
Length Access Road 4	250	ft		
Access road width (assumed):	20	ft		
TOTAL ACCESS ROAD AREA:	14,000	SF, or	1,556	SY

2. Assume access roads 1, 2, and 3 will need clearing and grubbing; Access Road 4 will not need clearing or grubbing because it takes advantage of an existing dirt parking lot.

TOTAL ACCESS ROAD AREA REQUIRING CLEARING:	9,000	SF	500	SY
3. Assume the following number of staging areas.	1			
Each staging area is approx:	250	ft	125	ft
	31,250	SF, or	0.7	acres
4. Estimated Volumes and Areas at Former United Paperboard Company				
Volume of Hazardous Material	800	BCY		
Volume of NonHazardous Material	38,200	BCY		
Cutback Volume	0	BCY		
Surface Area of Contaminated Material	117,000	SF		
5. Estimated Volumes and Areas at Upson Park				
Volume of Hazardous Material	4,100	BCY		
Volume of NonHazardous Material	115,900	BCY		
Cutback Volume	0	BCY		
Surface Area of Contaminated Material	192,000	SF		
6. Estimated Volumes and Areas at White Transportation				
Volume of Hazardous Material	0	BCY		
Volume of NonHazardous Material	34,000	BCY		
Cutback Volume	0	BCY		
Surface Area of Contaminated Material	82,000	SF		
7. Estimated Total Site Perimeter (the 3 OUs)	5,125	LF		
8. Estimated Length of Creek adjacent to properties (includes both banks of creek)	4,500	LF		
9. Assume verification sampling grid spacing:	25	ft		
10. Construction Duration (Assuming 5 day work week)	5	construction seasons, 8 months each		
11. Conversion from BCY to LCY (dewatered material):	1.15	LCY/BCY		
12. Conversion from BCY to tons (dewatered material):	1.5	tons/BCY		
13. Conversion from BCY to LCY (saturated material):	1.12	LCY/BCY		
14. Conversion from BCY to tons (saturated material):	1.7	tons/BCY		

15. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the

Table 3-11 Cost Estimate, Alternative 6 - Complete Excavation and Off-site Disposal of Material With COCs Exceeding Unrestricted Use SCOs and Bank Stabilization, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
16. Costs presented are based on conventional contracting methods.					
17. Assume tree and shrub planting grid spacing every		25	ft		
18. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:			Year	Index #	
			2008	180.4	
			2009	185.9	

Key:
BCY = Bank cubic yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards
LF = Linear feet.
LS = Lump sum.
LTM = Long-term monitoring.
Mo = Month.
MSF = 1000 square feet.
OU = Operable Unit.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 3-12 Summary of Total Present Worth Values of Alternatives, OU-3, OU-4, OU-5, Eighteenmile Creek Corridor Site, Lockport, New York

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Description	No Action	Institutional Controls, Bank Stabilization, and Long Term Monitoring	Limited Excavation, Off-site Disposal, Containment of Areas With COCs Exceeding Commercial SCOs, Institutional Controls, Bank Stabilization, and Long Term Monitoring	Complete Excavation, Off-site Disposal, Bank Stabilization, and Long Term Monitoring	Limited Excavation, Off-site Disposal, Complete Containment, Institutional Controls, Bank Stabilization, and Long Term Monitoring	Complete Excavation and Off-site Disposal of Material With COCs Exceeding Unrestricted Use SCOs and Bank Stabilization
Total Project Duration (Years)	0	30	30	30	30	5
Capital Cost	$0	$1,218,000	$5,276,000	$6,087,000	$9,414,000	$42,963,000
30-year Present Worth of Annual O&M Cost	$0	$175,000	$175,000	$175,000	$175,000	$175,000
30-year Present Worth of Periodic O&M Cost	$0	$218,000	$151,000	$94,000	$629,000	$55,000
2009 Total Present Value of Alternatives	**$0**	**$1,611,000**	**$5,602,000**	**$6,356,000**	**$10,218,000**	**$43,193,000**

Note:

All costs are in 2009 Dollars

Compliance with SCGs

Site contaminants (PCBs and metals) are resistant compounds by nature and are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site.

Short-term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved.

This alternative does not include source removal or treatment and would not meet the RAOs (as defined in Section 3.2.2) in a reasonable or predictable timeframe.

Long-term Effectiveness and Permanence

Because this alternative does not involve removal or treatment of the contaminated soil, risks associated with direct contact and ingestion with the soil, and migration of contaminants to creek sediments will essentially remain the same. This alternative is, therefore, not effective in the long-term.

Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative does not involve removal or treatment of contaminated soil; therefore, the toxicity, mobility, and volume of contamination will not be reduced.

Implementability

There are no actions to implement under this alternative.

Cost

There are no costs associated with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, a portion of the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions of the properties that are densely vegetated and wooded along the banks of Eighteenmile Creek. Implementation of this alternative would not impact current or anticipated future land uses at these properties as no remedial actions are associated with this alternative. However, site risks will remain as they are currently.

3.5.3.2 Alternative No. 2: Institutional Controls, Bank Stabilization, and Long-term Monitoring

3.5.3.2.1 Description

ICs including access/use and environmental easements and physical barriers such as fencing and signage (herein referred to as ICs) will be applied at this site. Environmental easements would be filed to control future use/activities at the site to limit human exposure to contaminated soils. Fencing will be installed to encompass soil contamination as shown on Figure 3-2. Since these sites exist near the creek, an evaluation would need to be performed to determine the impacts of installing fences along the creek. Pending results from this evaluation, this alternative can be readily implemented.

In addition to ICs, this alternative includes bank stabilization measures to limit on-site contaminated soils from eroding and entering the creek. For costing purposes, it is assumed that these measures will be implemented continuously along the creek banks at these three properties, including the Former United Paperboard Company parcel located north of Olcott Street, and will consist of a 12-inch layer of topsoil extending 10 to 20 feet upland of the bankfull elevation. The topsoil layer will be placed directly over the existing ground surface or over temporary access roads used to perform sediment remediation as described in Section 2. It is also assumed that a layer of jute mesh erosion control matting will be placed on top of the topsoil and will be planted with native grasses and plantings.

Access roads and a staging area will need to be constructed to support remediation of OU-1 sediments, as discussed in Section 2. Since it is assumed that remediation of OU-1 will be performed in conjunction with this alternative for the adjacent upland properties (OU-3, OU-4, and OU-5), costs for construction and restoration of these measures are included in the costs for this alternative.

Since contaminated material will remain on site, long-term monitoring will need to be conducted to monitor the effectiveness of the bank stabilization measures. It is assumed that remediation of the commercial properties will be performed in cooperation with remediation of the creek itself. Therefore, monitoring of creek sediments is included in remedial alternatives for OU-1 Eighteenmile Creek and Millrace (Section 2). Under this alternative, LTM will consist of annual inspection and repair of the bank stabilization measures and site fencing/signage.

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required at the site.

3.5.3.2.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

Placement of ICs, such as access and environmental easements (that would control future use/activities at the site), would provide some long-term protection of human health. Fencing and signs alone may not be adequate to prevent unauthorized access to the site by trespassers (who could potentially directly contact

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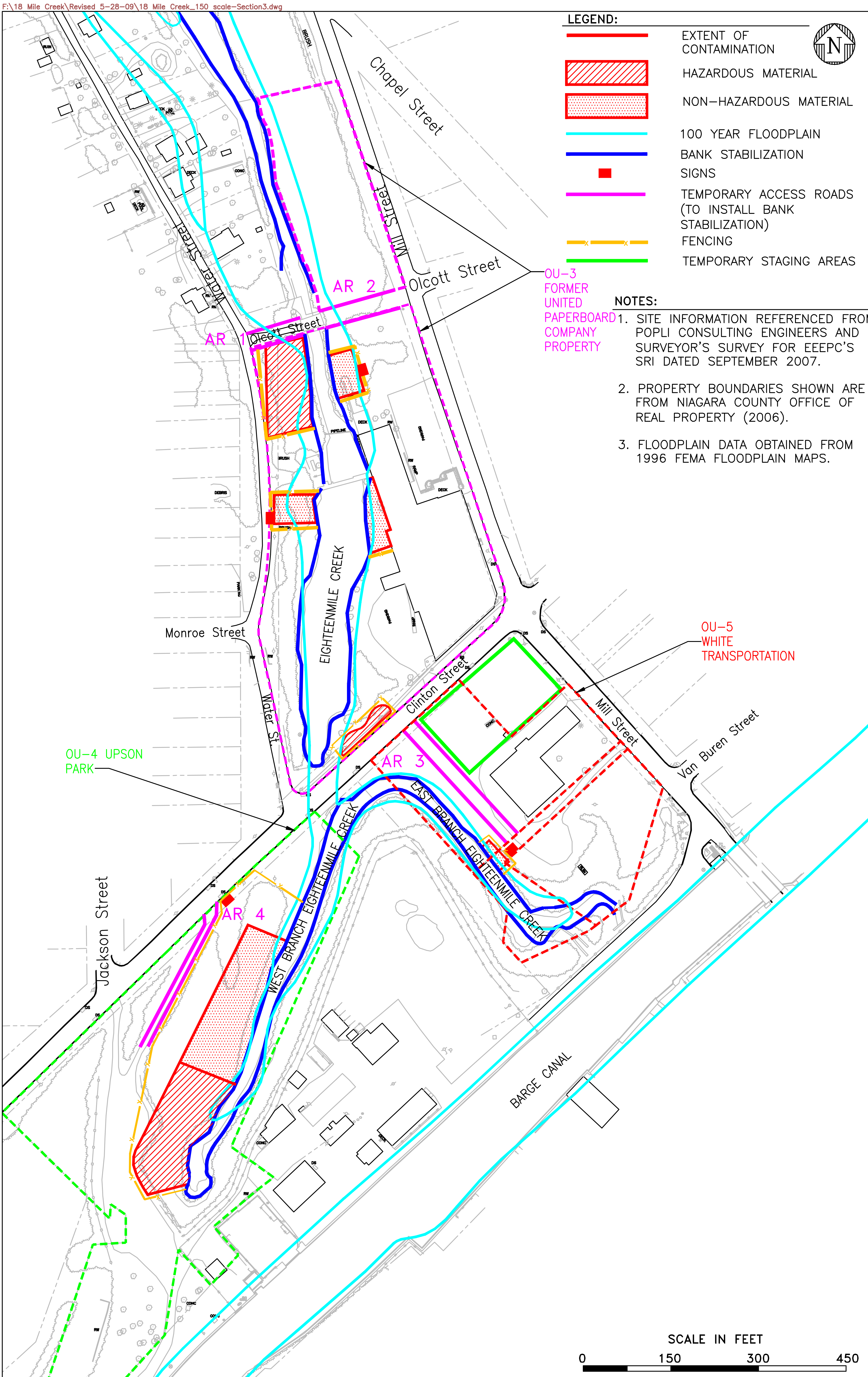

NOTES:

1. SITE INFORMATION REFERENCED FROM POPLI CONSULTING ENGINEERS AND SURVEYOR'S SURVEY FOR EEEPC'S SRI DATED SEPTEMBER 2007.
2. PROPERTY BOUNDARIES SHOWN ARE FROM NIAGARA COUNTY OFFICE OF REAL PROPERTY (2006).
3. FLOODPLAIN DATA OBTAINED FROM 1996 FEMA FLOODPLAIN MAPS.

ecology and environment

FIGURE 3-2 INSTITUTIONAL CONTROLS, BANK STABILIZATION, AND LTM OU-3, OU-4, AND OU-5 EIGHTEENMILE CREEK CORRIDOR SITE LOCKPORT, NEW YORK contaminants). In addition, fencing would provide limited protection for certain ecological receptors from direct contact and/or ingestion of site contaminants. Bank stabilization measures would limit erosion of contaminated site soils from transporting to the creek.

Compliance with SCGs

The contaminant levels in soil are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site. Action-specific and location-specific SCGs (e.g., safety regulations) would be included in the ICs and complied with for site activities.

Short-term Impacts and Effectiveness

No significant short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved. Controlling future use and activities on site would protect the health of human receptors at these sites. This alternative would provide some protection to the community by notifying the public of site hazards and limiting site access. This alternative will achieve site RAOs by limiting direct human and ecological contact with impacted material.

Long-term Effectiveness and Permanence

This alternative would not be effective in the long term because it does not involve removal or treatment of contaminated soil. Although the risks associated with direct contact with on-site contaminants would be reduced somewhat by this alternative, contaminant levels will ultimately remain the same and the potential for future exposure will always exist. Environmental easements and access restrictions would be effective in the long term as long as they are interpreted correctly, not modified by future site users, and are enforced. Bank stabilization measures would be effective in limiting erosion, as long as they are maintained properly.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not involve the removal or treatment of contaminated soil. Therefore, neither the toxicity, nor mobility, nor volume of contamination is expected to be reduced. Migration of contaminants via erosion will be reduced by bank stabilization measures.

Implementability

This alternative can be readily implemented on a technical and administrative basis using typical IC practices and procedures. However, it may be difficult to ensure long-term enforcement of environmental easements and access restrictions.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is \$1,611,000. Table 3-7 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means Cost Data series, ECHOS, quotes from contractors, and engineering judgment. Maintenance of bank stabilization measures and ICs are assumed with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions that are densely vegetated and wooded along the banks of Eighteenmile Creek. Implementation of this alternative may limit the usability of the sites, as environmental easements and physical barriers will be in place.

3.5.3.3 Alternative No. 3: Limited Excavation and Off-site Disposal, Containment of Areas Exceeding Commercial Use SCOs, Bank Stabilization, and Long-term Monitoring

3.5.3.3.1 Detailed Description

This alternative involves limited excavation and off-site disposal of soils that exceed SCOs and are considered hazardous and containment (in place) of soils that exceed SCOs but are considered non-hazardous for PCBs and/or metals contamination. In addition, contaminated areas on steep slopes will be excavated and disposed off-site as constructing a stable cover on slopes steeper than 3H:1V is difficult to achieve. As defined by 40 CFR 261, soils with concentrations of PCBs greater than 50 ppm and soils with metals concentrations that exceed the TCLP test limits are considered hazardous. The locations of the areas to be excavated are presented in Figure 3-3.

As portions of the site are located within the 100-year floodplain, an evaluation would need to be performed to determine the impacts of raising grades at the site due to construction of a cover, prior to implementation of this alternative. Pending results from this evaluation that indicate placement of a cover at this site would be acceptable, this alternative can be readily implemented as follows.

The volume of hazardous material to be removed was estimated based on sampling data presented in the SRI (EEEPC 2009b). The SRI concluded that no correlation could be determined between contaminant concentrations and TCLP test failures, which would characterize the waste as hazardous. Therefore, it was assumed for the purposes of this FS that hazardous material was confined to localized areas where sampling indicated failure of TCLP tests for metals, or where PCB concentrations were greater than 50 ppm. These areas are indicated on Figure 3-3. In the field, all soils will be subject to characterization sampling, which will determine whether the material is treated as hazardous or not.

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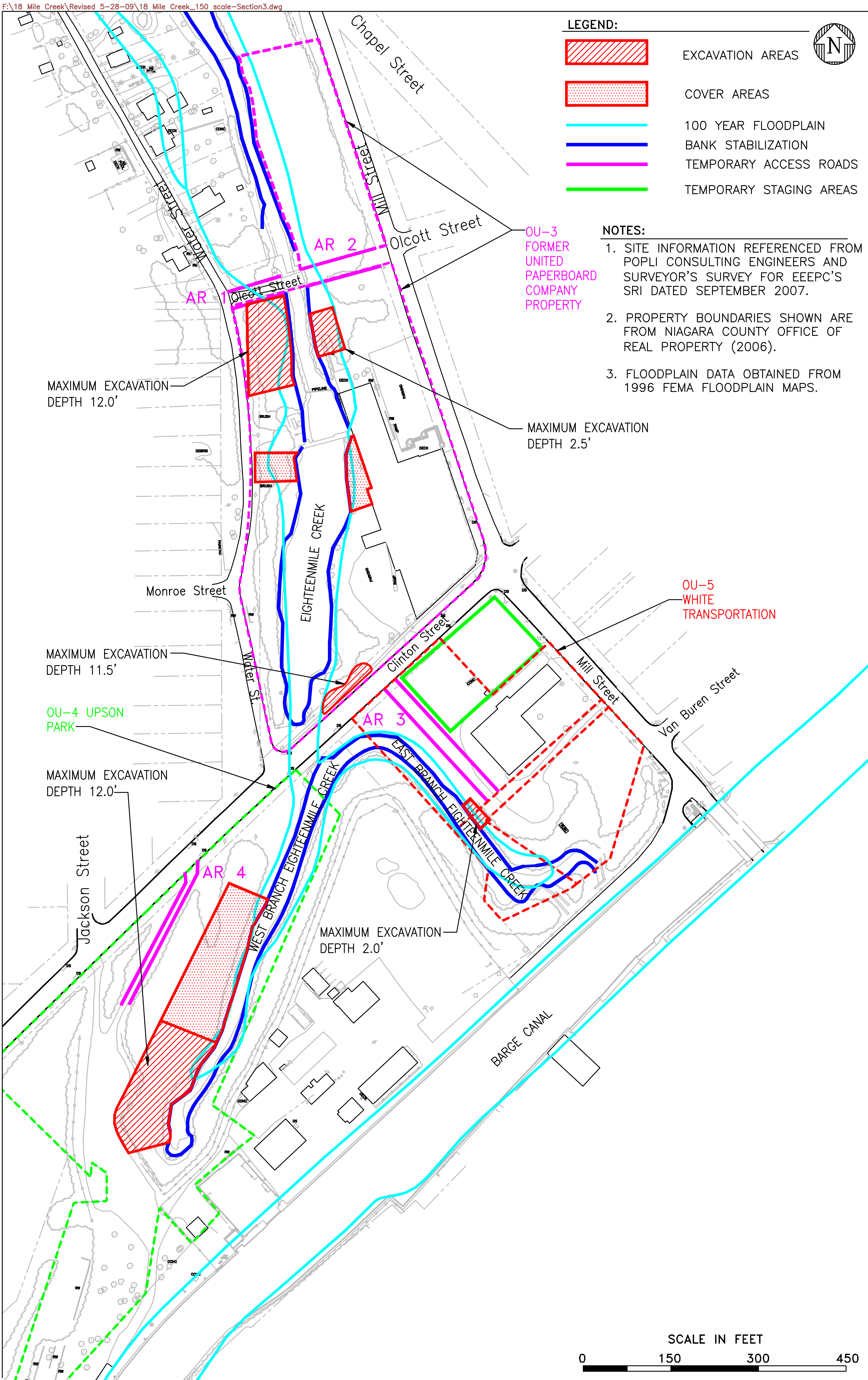

FIGURE 3-3 LIMITED EXCAVATION, OFF-SITE DISPOSAL, CONTAINMENT OF AREAS WITH COCs EXCEEDING COMMERCIAL USE SCOS, BANK STABILIZATION, AND LTM OU-3. OU-4. AND OU-5 EIGHTEENMILE CREEK CORRIDOR SITE LOCKPORT, NEW YORK

Prior to implementation of this alternative, temporary access roads (from public roads to areas of contaminated soil) and a fenced staging area will be constructed.

Excavation of the contaminated soil will be performed using conventional construction equipment such as hydraulic excavators and bulldozers. To ensure safe working conditions in the excavation at all times, cutback of the excavation areas may be required. Based on a cutback slope of 3:1, cutback will likely be required at the OU-3, the Former United Paperboard Company property and possibly OU-4, Upson Park. The volume of the cutback material to be excavated is considered minor in comparison to the contaminated soil volume and was, therefore, not considered in the cost estimate. This soil will be staged separately from contaminated materials and used as site backfill.

During the excavation process, sampling will be conducted for metals and PCBs. TCLP tests will also need to be performed to characterize material for disposal. The results of this sampling along with the approval of NYSDEC will be used to verify that cleanup goals have been reached in the selected areas of excavation. The goal will be to determine if the remaining soil exceeds cleanup goals, thus requiring additional excavation, or if the results indicate that the remaining soils are not above cleanup goals, providing documentation that additional excavation is not necessary. A sampling grid will be developed over the soil area for NYSDEC's approval.

Handling, transport, and disposal of hazardous materials will be performed in accordance with RCRA regulations. Engineering controls will be employed to reduce short-term negative impacts to the community or environment that might result from excavation of contaminated material. These will include decontamination of vehicles and personnel leaving the site as well as erosion controls such as silt fences.

Groundwater elevations in the vicinity of 18MC-MW05 (west bank of the Former United Paperboard Company property) are relatively close to the assumed maximum excavation depth of 12 feet BGS in this area. Similarly, the groundwater elevation near 18MC-MW08 is close to the assumed maximum excavation depth of 11.5 feet BGS. For purposes of this FS, it is assumed that dewatering will not be necessary during excavation of material at the three OUs. However, dewatering may prove to be necessary during the design phase.

Following confirmatory sampling and the approval of NYSDEC, excavated areas will be backfilled to final grade, compacted, and restored to pre-construction conditions to the extent practicable. Since excavation will result in a significant reduction of on-site soils, clean backfill material will need to be imported to the site. The top 6 inches of backfill will be a layer of topsoil which will be seeded and planted for trees and shrubs.

Soils that exceed SCOs but are not considered hazardous will remain on site but will be covered in place by a geofabric, demarcation layer (such as snow fence) and a 2-foot-thick clean soil cover. The top 6 inches of the soil cover will be of sufficient quality to support vegetation except in areas along the creek where additional stabilization measures are needed to protect the cover from erosional forces from the creek. For costing purposes, a 12-inch layer of medium to heavy sized stone will be placed over the soil cover system described above on areas along the creek.

Similar to Alternative 2, bank stabilization measures will be installed along the creek banks to limit remaining on-site contaminated soils from eroding to Eighteenmile Creek.

Temporary access roads and staging areas will be removed and the disturbed areas will be restored to the pre-construction conditions, to the extent practicable. This will include placement of backfill as necessary, followed by seeding and planting of native grasses, shrubs, and/or trees.

Since contaminated material above the selected cleanup goals will remain on site, a long-term monitoring plan similar to what is described in Alternative 2 will be implemented. In addition, monitoring and maintenance of the soil covers will need to be performed. Monitoring was assumed to occur annually, whereas maintenance of the soil cover would be performed as needed.

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required at the site.

3.5.3.3.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment since contaminated soils would either be removed from the site or contained in place. Although some contaminated material above the SCOs would remain on site, this material would be contained in place by a 2-foot-thick soil cover, thereby reducing the potential for exposure by human and ecological receptors. Bank stabilization measures will limit contaminated soils from eroding to the creek.

Compliance with SCGs

This alternative will not meet chemical specific SCGs since some soils exceeding the selected cleanup goals will remain on site. Applicable action- and location-specific SCGs will be achieved through the use of engineering and ICs during excavation and covering activities.

Short-term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation of contaminated soil from the sites. Intrusive activities may expose workers to contaminants and the potential exists for direct contact with contaminated material. With this alternative there is also an increased risk to workers due to the use of heavy equipment required to excavate the soil. Community impacts include dust and noise from equipment operation.

To minimize these short-term impacts, site access will be restricted during excavation and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels for the site will be set prior to any intrusive activities, and an appropriate corrective action will be implemented if these action levels are exceeded.

This alternative will achieve two of the three RAOs at the completion of this work. Installation of a cover and excavation of hazardous soils is anticipated to be completed within one to two years, consisting of 6 month construction seasons. Additional time would be needed for engineering design, mobilization, and demobilization.

Long-term Effectiveness and Permanence

This alternative is considered to be effective in the long term, as long as proper inspection, operation, and maintenance is conducted. Since some contaminated soils above the selected cleanup goals will remain on site, the risk of exposure to human and ecological receptors will exist. However, diligent inspection and maintenance of the soil cover and bank stabilization measures will mitigate these risks.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment (unless the landfill facility treats hazardous material prior to disposal). However, excavation and off-site disposal of contaminated soils will reduce the volume of contaminated soil at the site. Since these soils will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. Some challenges may arise due to the lack of space on the site properties. This may present a particular problem for construction of staging areas and support facilities. However, it is assumed for this study that the White Transportation property has enough available space for these needs.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $5,602,000. Table 3-8 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means series, ECHOS, quotes from contractors, and engineering judgment. Maintenance of bank stabilization measures and the soil covers are assumed with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions of the properties that are densely vegetated and wooded along the banks of Eighteenmile Creek.

Although some contaminated soil will remain on site, it will be covered, thereby reducing exposure risks. As such, it is expected that this alternative will allow future use of the properties to be unaffected. However, environmental easements may limit certain activities at the properties.

3.5.3.4 Alternative No. 4: Complete Excavation and Off-site Disposal, Bank Stabilization, and Long-term Monitoring

3.5.3.4.1 Detailed Description

This alternative is similar to Alternative 3 with the exception that both hazardous and non-hazardous material exceeding selected cleanup goals will be excavated and disposed off site. The location of areas to be excavated are presented in Figure 3-4.

Excavation, material staging, and off-site disposal of material will be performed as described in Alternative 3. Material considered hazardous will be segregated from non-hazardous material at the staging area, characterized, and disposed off site at an appropriate disposal facility. Cutback material will be used as site backfill.

Excavated areas will be backfilled to final grade, compacted, and restored to preconstructions conditions, to the extent practicable. Since excavation will result in a significant reduction of on-site soils, clean backfill material will need to be imported to the site. The top 6 inches of backfill will be a layer of topsoil, which will be seeded and planted with native grasses, trees, and/or shrubs.

Bank stabilization measures and LTM will be performed as described in Alternative 2.

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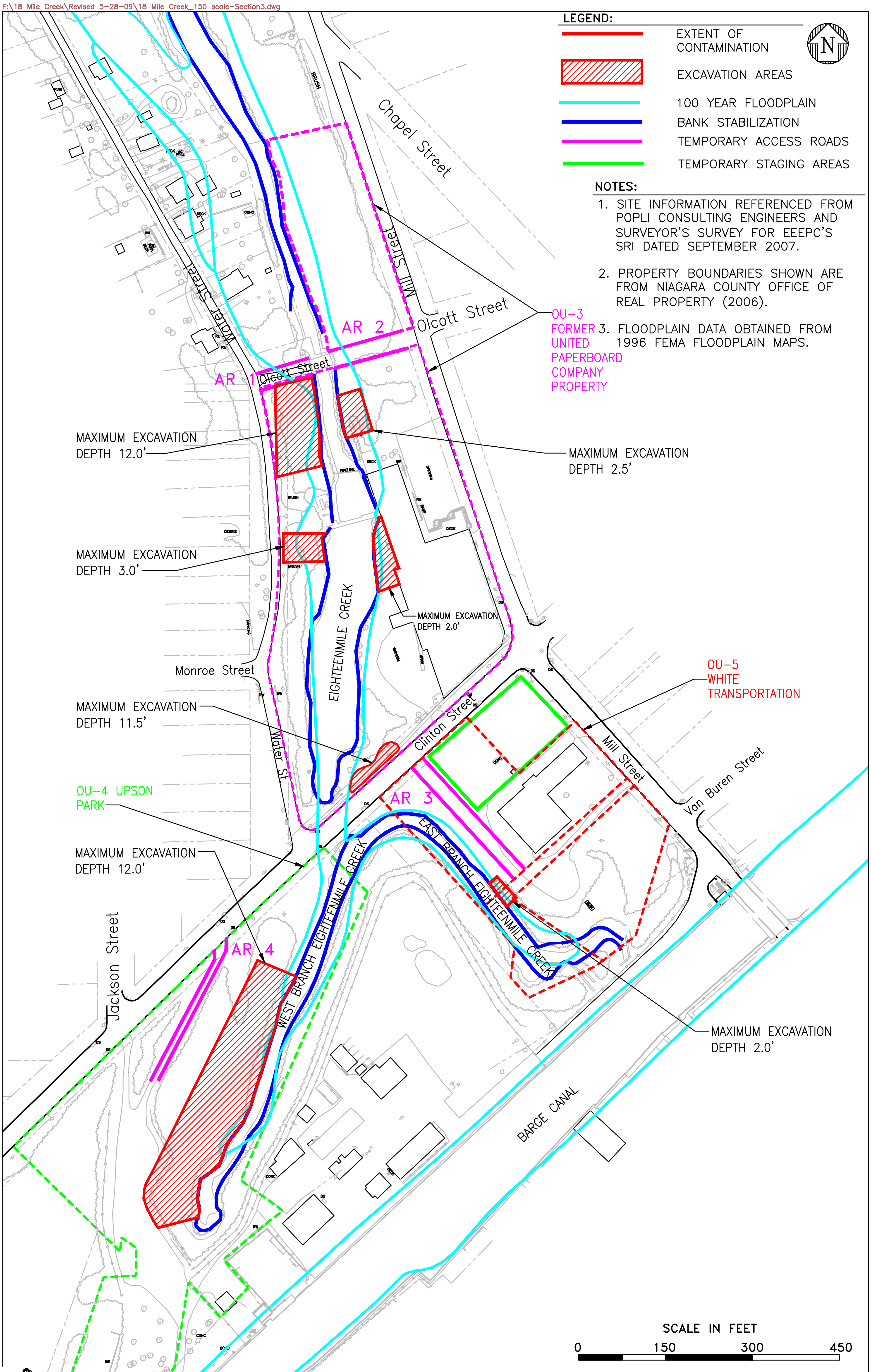

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FIGURE 3-4 COMPLETE EXCAVATION, OFF-SITE DISPOSAL, AND BANK STABILIZATION OU-3. OU-4. AND OU-5 EIGHTEENMILE CREEK CORRIDOR SITE LOCKPORT, NEW YORK

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required at the site.

3.5.3.4.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment
This alternative is protective of human health and the environment since contaminated soils will be removed from the site and properly disposed of in an acceptable facility. The contaminated soil will no longer present an exposure risk to human and ecological receptors. Bank stabilization measures will limit the erosion of soils and reduce the environmental risk to the creek to the maximum extent practicable.

Compliance with SCGs
This alternative complies with SCGs since contaminated soils will be removed from the site and properly disposed of in an acceptable facility. Off-site disposal will comply with all applicable land disposal restrictions and analytical requirements. Action- and location-specific SCGs including noise limitations, wetlands permits (as required), and OSHA regulations will be complied with during implementation of this alternative.

Short-term Impacts and Effectiveness
Several short-term impacts to the community and workers may arise during excavation of contaminated soil at the site. These include dust, noise, and potential spills during handling and transportation of contaminants. To minimize short-term impacts, site access will be restricted during construction and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded.

Off-site transportation of contaminated soil to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be limited by using closed and lined containers for transport.

Because this alternative involves removal of the contaminated soil from the site and replacement with clean fill, site RAOs will be achieved at the completion of this work. The time to complete this alternative is estimated to be approximately one to two years, consisting of 6 month construction seasons. Additional time for engineering design, mobilization, and demobilization would also be required.

Long-term Effectiveness and Permanence

Removal and off-site disposal is considered to be an adequate and effective remedy in the long-term since the contaminated soil will no longer represent an environmental risk.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment. However, excavation and off-site disposal of contaminated soils will eliminate concerns associated with toxicity and mobility of the contaminants at the site. Since the contaminated soil will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. Local disposal facilities accepting hazardous and non-hazardous wastes have been identified and the capacity of these facilities can easily accommodate the volume of material to be excavated. Environmental remediation contractors and licensed trucking companies for transport of wastes are also readily available.

Some challenges may arise due to the lack of space on the site properties. This may present an issue for construction of staging areas and support facilities. However, it is assumed for this FS that the White Transportation property has enough available space for these needs.

Cost

The 2009 total present-worth cost of this alternative is $6,356,000. Table 3-9 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means Cost Data series, ECHOS, contractor quotes, and engineering judgment. Maintenance of bank stabilization measures is assumed with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions of the properties that are densely vegetated and wooded along the banks of Eighteenmile Creek. It is anticipated that the future use of these sites will not be impacted by remedial actions described in this alternative as contaminated soils will be removed from the properties and the land restored to pre-construction conditions.

3.5.3.5 Alternative No. 5: Limited Excavation and Off-site Disposal, Complete Containment, Bank Stabilization, and Long-term Monitoring

3.5.3.5.1 Detailed Description

This alternative is similar to Alternative 3 with the exception that all soils and fill material not excavated would be covered in place. This includes material with COCs detected above commercial use SCOs, as well as all other exposed soils and fill material within the OU boundaries. Excavation and disposal, containment, bank stabilization, and long-term monitoring would be performed as described in Alternatives 2 and 3. Figure 3-5 shows the locations of areas to be excavated and covered under this alternative.

Soil covers would be installed on the upland properties as described in Alternative 3. It is assumed that grading and slope stabilization would be needed along the creek banks in steeply sloped areas to allow for construction of a stable cover. Additionally, this alternative includes covers for existing gravel roadways and parking areas on the Former United Paperboard Company and Upson Park properties. These areas would be covered by light-use asphalt paving to limit direct contact with underlying material and to form a better delineation with the surrounding soil covers. For costing purposes, it is assumed that the cover in these areas would consist of 12 inches of clean soil, 8 inches of crushed stone, a 2½-inch binder course, and a 1½-inch wearing course.

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required at the site.

3.5.3.5.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment since contaminated soils would either be removed from the site or contained in place. Although some contaminated material above the SCOs would remain on site, this material would be contained in place by a 2-foot-thick cover, thereby reducing the potential for exposure by human and ecological receptors. Bank stabilization measures will limit contaminated soils from eroding to the creek.

Compliance with SCGs

This alternative will not meet chemical-specific SCGs since some soils exceeding the selected cleanup goals will remain on site. Applicable action- and location-specific SCGs will be achieved through the use of engineering and ICs during excavation and covering activities.

Short-term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation of contaminated soil from the sites. Intrusive activities may expose workers to contaminants and the potential exists for direct contact with contaminated material. With this alternative, there is also an increased risk to workers due to the use of heavy equipment required to excavate the soil. Community impacts include dust and noise from equipment operation.

To minimize these short-term impacts, site access will be restricted during excavation and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels for the site will be set prior to any intrusive activities, and an appropriate corrective action will be implemented if these action levels are exceeded.

This alternative will achieve two of the three RAOs at the completion of this work. Installation of a cover and excavation of hazardous soils is anticipated to be completed within 2 to 3 years, consisting of 6 month construction seasons. Additional time would be needed for engineering design, mobilization, and demobilization.

Long-term Effectiveness and Permanence

This alternative is considered to be effective in the long term, as long as proper inspection, operation, and maintenance is conducted. Since some contaminated soils above the selected cleanup goals will remain on site, the risk of exposure to human and ecological receptors will exist. However, diligent inspection and maintenance of the soil cover and bank stabilization measures will mitigate these risks.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment (unless the landfill facility treats hazardous material prior to disposal). However, excavation and off-site disposal of contaminated soils will reduce the volume of contaminated soil at the site. Since these soils will be disposed in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. Some challenges may arise due to the lack of space on the site properties. This may present a particular problem for construction of staging areas and support facilities. However, it is assumed for this study that the White Transportation property has enough available space for these needs.

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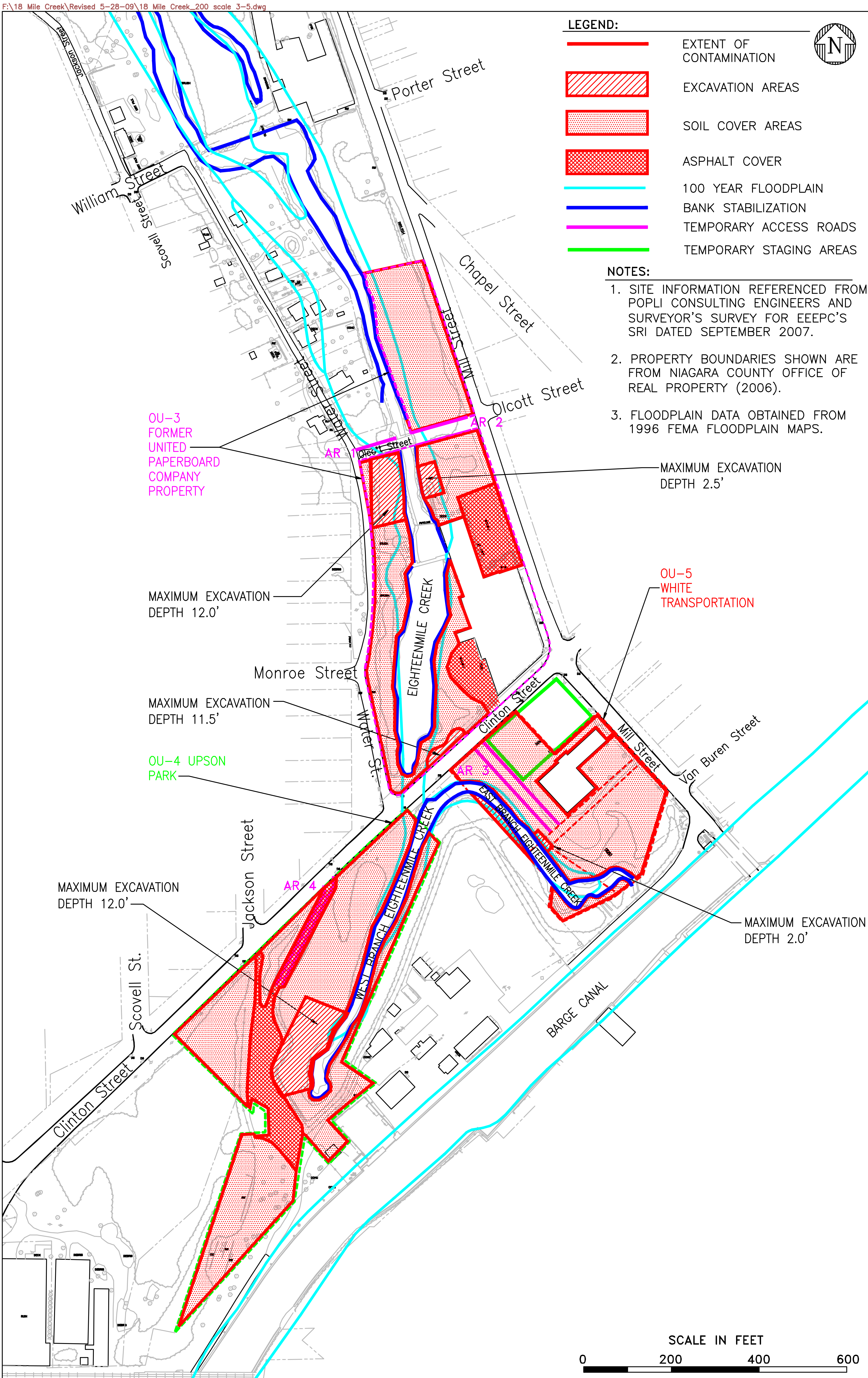

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FIGURE 3-5 LIMITED EXCAVATION, OFF-SITE DISPOSAL, COMPLETE CONTAINMENT, BANK STABILIZATION, AND LTM
OU-3, OU-4, AND OU-5 EIGHTEENMILE CREEK CORRIDOR SITE
LOCKPORT, NEW YORK

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $10,218,000. Table 3-10 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means series, ECHOS, quotes from contractors, and engineering judgment. Maintenance of bank stabilization measures and the soil covers are assumed with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions that are densely vegetated and wooded along the banks of Eighteenmile Creek.

Although some contaminated soil will remain on site, it will be covered, thereby reducing exposure risks. As such, it is expected that this alternative will allow future use of the properties to be unaffected. However, environmental easements may limit certain activities at the properties.

3.5.3.6 Alternative No. 6: Complete Excavation and Off-site Disposal of Material with COCs Exceeding Unrestricted Use SCOs and Bank Stabilization

3.5.3.6.1 Detailed Description

This alternative is similar to Alternative 4 with the exception that all material with COCs exceeding unrestricted use SCOs would be excavated and disposed off site. The locations of areas to be excavated are presented in Figure 3-6.

Excavation, material staging, and off-site disposal of material will be performed as described in Alternatives 3 and 4. Since all material exceeding unrestricted use SCOs would be disposed off site, LTM would not be needed. Five-year reviews would also not be required. However, it is assumed that bank stabilization measures would still be implemented along the creek banks to protect the reconstructed banks and prevent erosion.

3.5.3.6.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment since contaminated soils will be removed from the site and properly disposed of in an acceptable facility. The contaminated soil will no longer present an exposure risk to human and ecological receptors.

Compliance with SCGs

This alternative complies with SCGs since contaminated soils will be removed from the site and properly disposed of in an acceptable facility. Off-site disposal will comply with all applicable land disposal restrictions and analytical requirements. Action- and location-specific SCGs including noise limitations, wetlands permits (as required), and OSHA regulations will be complied with during implementation of this alternative.

Short-term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation of contaminated soil at the site. These include dust, noise, and potential spills during handling and transportation of contaminants. To minimize short-term impacts, site access will be restricted during construction and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate corrective action will be implemented if these action levels are exceeded.

Off-site transportation of contaminated soil to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be limited by using closed and lined containers for transport.

Because this alternative involves removal of the contaminated soil from the site and replacement with clean fill, site RAOs will be achieved at the completion of this work. The time to complete this alternative is estimated to be approximately 5 years, consisting of 8 month construction seasons each. It is anticipated that a longer than average construction season would be used in order to accommodate the large volume of material to be excavated. Additional time for engineering design, mobilization, and demobilization would also be required.

Long-term Effectiveness and Permanence

Removal and off-site disposal are considered to be adequate and effective remedies in the long-term since the contaminated soil will no longer represent an environmental risk.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment. However, excavation and off-site disposal of contaminated soils will eliminate concerns associated with toxicity and mobility of the contaminants at the site. Since the contaminated soil will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

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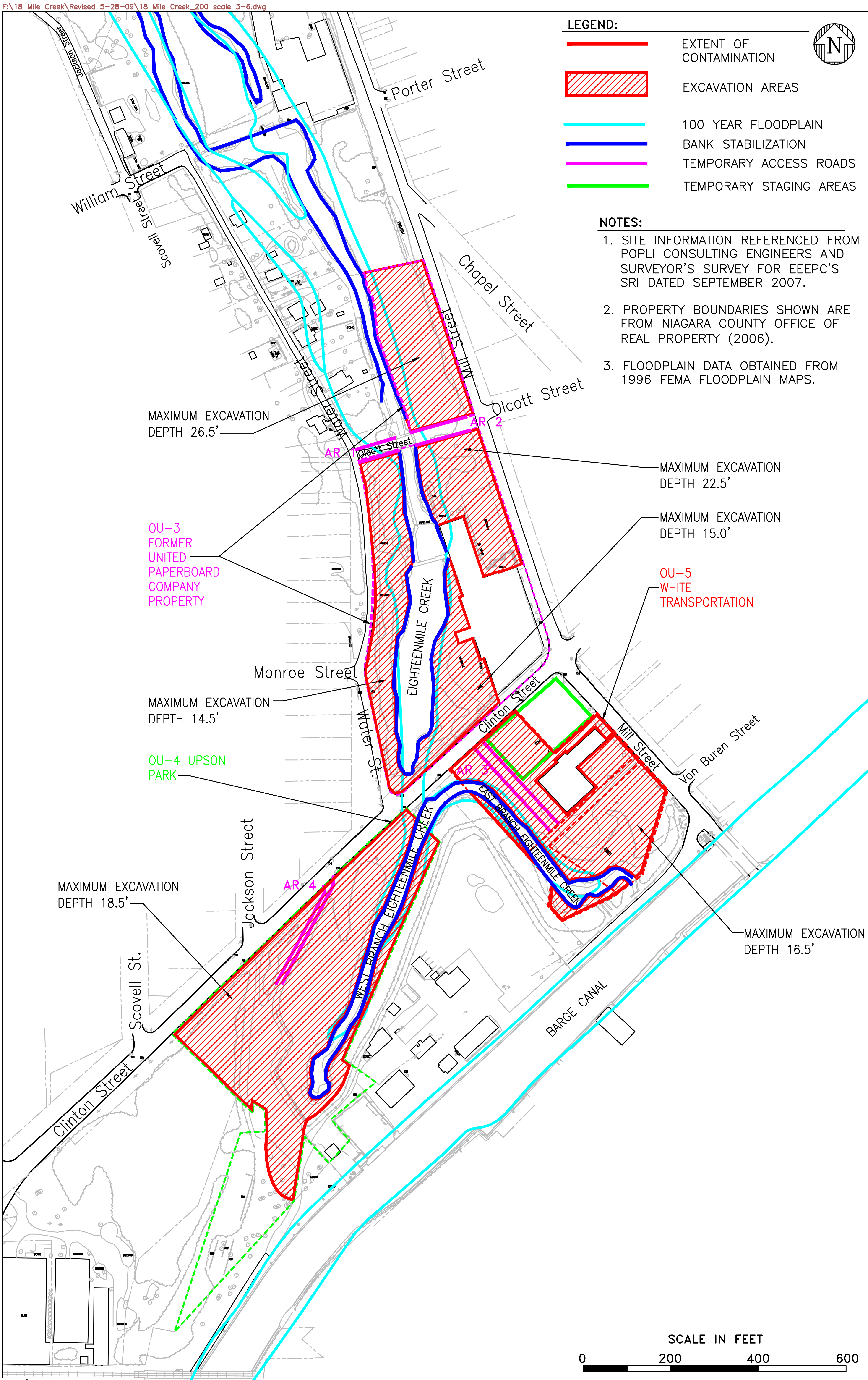

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FIGURE 3-6 COMPLETE EXCAVATION AND OFF-SITE DISPOSAL OF MATERIAL WITH COCs EXCEEDING UNRESTRICTED USE SCOs, AND BANK STABILIZATION OU-3. OU-4. AND OU-5 EIGHTEENMILE CREEK CORRIDOR SITE LOCKPORT, NEW YORK

Implementability

This alternative can be readily implemented using standard construction means and methods. Local disposal facilities accepting hazardous and non-hazardous wastes have been identified and the capacity of these facilities can easily accommodate the volume of material to be excavated. Environmental remediation contractors and licensed trucking companies for transport of wastes are also readily available.

Some challenges may arise due to the lack of space on the site properties. This may present an issue for construction of staging areas and support facilities. However, it is assumed for this FS that the White Transportation property has enough available space for these needs.

Cost

The 2009 total present-worth cost of this alternative is $43,193,000. Table 3-11 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means Cost Data series, ECHOS, contractor quotes, and engineering judgment. Maintenance of bank stabilization measures is assumed with this alternative.

Land Use

OU-3 and OU-5 are zoned industrial while OU-4 (Upson Park) is zoned as a reserved area for use as a park or wooded area. The current land use of these properties is not expected to change in the future. Currently, the Former United Paperboard Company property is occupied by an active business; the White Transportation property is inactive; and the Upson Park property consists of green space and pathways for recreational purposes. All three properties have portions that are densely vegetated and wooded along the banks of Eighteenmile Creek. Remedial actions described in this alternative would place no future restrictions on use at these properties as all contaminated soils would be removed and the land restored to pre-construction conditions.

3.6 Comparative Evaluation of Alternatives

Overall Protection of Human Health and the Environment

Since Alternative 1 employs no action, contaminated site soils will remain on site providing no protection for potential future exposure. Alternatives 2, 3, 4, 5, and 6 are more protective of human health and the environment, each at different levels. By only using ICs in Alternative 2, fencing and signage could reduce human exposure; however, inadequate enforcement could lead to potential health risks. Wildlife may also not be properly protected with this alternative. Alternative 3 provides a higher level of protection because soils considered hazardous will be removed and the remaining areas exceeding SCOs covered to reduce exposure. Similarly Alternative 5 provides a greater level of protection than Alternative 3, because all areas, not just those exceeding SCOs, would be covered to reduce exposure. Alternatives 4 and 6 provide the greatest protection as all site-wide contaminated soils at each OU, for commercial and unrestricted use SCOs respectively, would be excavated and disposed off site.

Compliance with SCGs

The concentrations of PCBs and metals are not expected to naturally decrease over time. Alternatives 1, 2, 3, and 5 do not fully comply with SCGs because contaminated soils will remain on site. Alternatives 4 and 6 comply with chemical-specific SCGs, for commercial and unrestricted use SCOs respectively, since soils exceeding SCOs will be excavated and properly disposed off site.

Short-term Impacts and Effectiveness

Short-term impacts are not anticipated for Alternative 1 since no remediation activities will take place. Minor short-term impacts would be expected for Alternative 2 due to construction of fencing and stabilization of the creek banks. Several short-term impacts may affect the community during remedial activities for Alternatives 3, 4, 5, and 6 such as dust and noise due to excavation of contaminated soil. There is also the potential for spills of contaminated soils and off-site tracking of contamination during transport. It is expected that engineering and administrative controls such as the use of PPE, community air monitoring, and effective decontamination of trucks will mitigate these impacts.

Long-term Effectiveness and Permanence

Since Alternative 1 employs no action, contaminated soil will remain on site providing no protection for potential future exposure. Alternative 2 is somewhat effective, provided proper enforcement of environmental easements and access restrictions. Alternatives 3 and 5 are effective in the long-term, as long as the soil covers and bank stabilization measures are properly maintained. Alternatives 4 and 6 have the highest degree of long-term effectiveness since soils exceeding SCOs will be excavated and removed from the site.

Reduction in Toxicity, Mobility, or Volume through Treatment

Reduction in toxicity, mobility, or volume through treatment will not be achieved in any of the alternatives since no treatment is being performed. However, in Alternatives 3, 4, 5 and 6, the volume of contaminated material will be reduced at the site, thereby reducing concerns of toxicity and mobility. Contaminated soils will be disposed at a designated permitted facility, where contaminant mobility will be effectively reduced.

Implementability

There are no actions to implement for Alternative 1. Alternatives 2, 3, 4, 5 and 6 are readily implemented using standard construction means and methods. The same concerns about limited on-site space apply equally to these alternatives.

Cost

Alternative 1 calls for no action, and thus incurs no costs. Alternative 2 has a lower total present worth than Alternatives 3, 4, 5, and 6 because no major capital costs are incurred. Alternatives 3 and 5 have lower present values than Alternatives 4 and 6 because less soil is excavated and disposed. However, these alternatives have higher annual and periodic O&M costs due to anticipated maintenance of the soil cover. Alternatives 5 and 6 have higher present values than Alternatives 3 and 4 respectively because these alternatives involve remediation of larger areas and volumes of material.

Land Use

As contaminated soil will remain on site for Alternatives 1, 2, 3, and 5, future uses at the OUs may be limited. For Alternatives 4 and 6, soils exceeding SCOs will be removed. Thus, future use at the OUs would not be impacted.

4 OU-6: Water Street Residential Properties

4.1 Introduction

This section discusses the nature and extent of contamination and the feasibility of remedial alternatives for OU-6: Water Street Residential Properties. This OU consists of nine residential parcels situated along Water Street, between Olcott and William Streets. The parcel numbers range from 97 Water Street to 143 Water Street and are located immediately adjacent to the creek. The limits of the OU boundary are generally defined by property boundaries and the creek bankfull elevation (see Figure 1-1), which was delineated based on visual observations made in late 2008, during the Additional Investigation (EEEPC 2009a). Soils upland of the creek bankfull elevation are considered part of this OU, while soils and sediments within the bankfull elevation are considered part of OU-1: Eighteenmile Creek and Millrace, which is addressed separately in Section 2 of this report.

This chapter of the report is organized as follows:

- Section 4.1 provides the study purpose and the site background information;
- Section 4.2 presents the identification of SCGs for various contaminants and the development of RAOs;
- Section 4.3 evaluates appropriate technologies for the remediation of site contamination and the development of remedial alternatives;
- Section 4.4 discusses the combination of remedial technologies to form remedial alternatives and the detailed analysis of the alternatives;
- Section 4.5 presents a detailed analysis of alternatives; and
- Section 4.6 presents a comparative analysis of the alternatives.

4.1.1 Background Information

4.1.1.1 Site Description and Previous Investigations

The Water Street Residential Properties are privately owned parcels of land consisting of single family housing. The properties are adjacent to Eighteenmile Creek and occasionally experience flooding due to high water events. Severe flooding of up to 100 feet horizontally reportedly occurs approximately once every two years, with lesser flooding occurring several times a year due to heavy precipitation and blockage of the cross-culverts under William Street.

Investigations at these properties began as a result of a request submitted to the Niagara County Health Department (NCHD) by the property owner at 143 Water Street. The resident was concerned of possible contaminant migration from Eighteenmile Creek after a family case of cancer. In 2002, NYSDEC, in consultation with the New York State Department of Health (NYSDOH) and NCHD, collected four samples from the Water Street property, followed by an additional 15 samples from the other Water Street properties (NYSDEC 2003). The 2005 NYSDEC RI investigated the nature and extent of contamination along these properties (NYSDEC 2006a). The SRI performed in 2008 investigated contamination at the adjacent commercial properties in order to uncover potential contaminant source areas as well as to better define the nature and extent of contamination in Eighteenmile Creek (EEEPC 2009b).

4.1.1.2 Site Geology and Hydrology

The geology and hydrology of OU-6 are similar to those of the other terrestrial OUs (see Section 3.1.2). Soil borings collected from the residential properties during the RI (NYSDEC 2006a) were generally consistent with what was observed during the SRI. Fill material was found throughout the properties at depths of up to approximately 6 feet, and was similar to the types of fill observed at the other OUs during the SRI.

4.1.1.3 Nature and Extent of Contamination

Sampling conducted during the RI (NYSDEC 2006a) indicated elevated concentrations of PCBs and metals, specifically arsenic, chromium, copper, lead, and zinc above screening levels in both the surface and subsurface soils at the Water Street Residential Properties. Additionally, some SVOCs were found at elevated concentrations in subsurface soil samples. This was attributed to PAHs in the ash, slag, and cinder fill found throughout the residential properties and Eighteenmile Creek Corridor. TLCP testing indicates the presence of hazardous soil along the northern boundary of the 143 Water Street property.

4.1.1.4 Contaminant Fate and Transport

The RI and SRI indicated that the fill material located throughout the terrestrial properties of the Eighteenmile Creek Corridor may be a source of PCB and metals contamination to the creek via erosion. Additionally, periodic creek flooding may be a source of contamination of floodplain soils at the residential properties because contaminated sediments are potentially deposited on these properties during flood events.

4.1.1.5 Qualitative Human Health Risk Evaluation

A qualitative human health exposure risk assessment conducted for the SRI identified four groups of receptors with distinctly different potentials for human exposure to contaminants in the Eighteenmile Creek Corridor. The receptors applicable to this OU include residents of the homes along Water Street with back yards abutting the creek (i.e., direct contact with contaminated yard soils).

4.1.1.6 Screening Level Ecological Risk Assessment

The residential properties were not specifically included in the FWIA performed for the SRI (EEEPC 2009b). However, consideration of these properties in the analysis does not affect the conclusions or completeness of the FWIA. Portions of the residential land are part of the creek floodplain, and floodplain soils are listed as a possible exposure media for ecological receptors in the ecological conceptual site model. Therefore, vegetation, soil invertebrates, and wildlife could be exposed to the elevated levels of PCBs, copper, lead, and zinc found in floodplain soils at the site.

4.2 Identification of Standards, Criteria, Guidelines, and Remedial Action Objectives

This section identifies the COCs and media of interest specific to OU 6: Water Street Residential Properties. It also establishes proposed cleanup goals and specific RAOs for contaminated on-site media and presents estimates of volumes of contaminated media for the properties, collectively.

4.2.1 Introduction

The RI (NYSDEC 2006a) identified PCB and metals contamination in surface and subsurface soils throughout the Water Street Residential Properties. Although the SRI did not further investigate contamination on these properties, potential risks associated with contamination were identified by evaluating contaminant concentrations and exposure routes.

The Human Health Risk Evaluation (HHRE) and FWIA conducted as part of the SRI (EEEPC 2009b) identified the following exposure risks:

- Direct dermal contact/incidental ingestion of contaminated soils by residents of these properties;
- Direct contact with and uptake from contaminated soils by plants and soil invertebrates; and
- Incidental ingestion of contaminated soils and consumption of contaminated prey by mammals, birds, and reptiles.

RAOs were developed (see Section 4.2.2) to mitigate these potential risks in two main ways: by eliminating routes of exposure and/or by reducing the contaminant concentrations in impacted media to meet applicable chemical-specific standards at the site.

SCGs are used at inactive hazardous waste sites to establish the locations where remedial actions are warranted and to establish cleanup goals. The following sections present potentially applicable SCGs and other standards and establish proposed cleanup goals and specific RAOs for contaminated on-site media.

4.2.2 Remedial Action Objectives

The RAOs for on-site remedial actions were developed based on information contained in the RI (NYSDEC 2006a) and SRI (EEEPC 2009b), including identified contaminants present in the study area and existing or potential exposure pathways in which the contaminants may affect human health and the environment.

The RAOs for on-site soils are to:

- Reduce the potential for human and ecological contact with contaminated soils;
- Reduce, to the extent practicable, future contamination of creek sediments by limiting erosion of terrestrial soils; and
- Achieve proposed cleanup goals for COCs based on an evaluation of ARARs.

4.2.3 Potentially Applicable Standards, Criteria, and Guidelines and Other Criteria

Refer to Section 3.2.3 for a description of SCGs and other criteria. Tables 4-1, 4-2, and 4-3 present Location, Action, and Chemical-specific SCGs for OU-6, respectively.

4.2.4 Cleanup Objectives and Volume of Impacted Material

The following sections describe the process used to select numeric cleanup objectives and estimate the volume of impacted material.

4.2.4.1 Selection of Soil Cleanup Goals

Standards

Refer to Section 3.2.4.1 for a description of Standards applicable to contaminants at OU-6.

Based on the city of Lockport Zoning Map (City of Lockport 2006), the Water Street properties are zoned as Reserved Areas. However, residents are currently living on these properties, and for the purpose of this report, it is anticipated that this residential land use will continue in the future. Therefore, based on this anticipated future use, the 6 NYCRR Subpart 375 – 6.8 SCOs selected for the protection of public health at these properties are Residential Use. These cleanup goals allow residents to use the land for any use other than raising livestock or producing animal products for human consumption.

Table 4-1 Location-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Location-Specific SCGs					
Environmental Conservation Law	Endangered and Threatened Species	6 NYCRR 182	Lists endangered and threatened species and species of special interest.	Not Applicable	FWIA (EEEPC 2009b) indicates no occurrences of rare or endangered species at site.
	Freshwater Wetlands	6 NYCRR 663-665	Establishes permit requirement regulations, wetland maps, and classifications.	Not Applicable	No state wetlands within Corridor Site
	Floodplain Management Regulations Development Permits	6 NYCRR 500	Describes development permitting requirements for areas in floodplains	Applicable	Floodplains exist along Eighteenmile Creek
	Use and Protection of Waters	6 NYCRR 608	Regulates the modification or disturbance of streams	Applicable	
	Wild, Scenic, and Recreational Rivers	6 NYCRR 666	Regulations for administration and management.	Relevant and Appropriate	
	Floodplains	6 NYCRR 502	Contains floodplain management criteria for state projects.	Relevant and Appropriate	Floodplains exist along Eighteenmile Creek
Federal Location-Specific SCGs					
National Historical Preservation Act 16 USC Section 469	Preservation of archaeological and historical data	36 CFR Part 65	Action to recover and preserve artifacts.	Relevant and Appropriate	
National Historic Preservation Act Section 106 (16 USC 470)	Historic landmarks, property, or projects owned or controlled by federal agencies	36 CFR Part 800	Preserve historic property, minimize harm to National Historic Landmarks.	Relevant and Appropriate	
Endangered Species Act of 1973 16 USC 1531, 661	Endangered and Threatened Species	50 CFR Part 200, 402 33 CFR Parts 320-330	Determine presence and conservation of endangered species.	Not Applicable	FWIA (EEEPC 2009b) indicates no occurrences of rare or endangered species at site.

Table 4-1 Location-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Clean Water Act Section 404	Wetland Protection	40 CFR Parts 230 33 CFR Parts 320-330	Action to prohibit discharge into wetlands.	Not Applicable	No federal wetlands in Corridor Site
Clean Water Act Part 6 Appendix A	Wetland Protection	40 CFR Part 6 Appendix A, section 4	Avoid adverse effects, minimize potential harm, preserve, and enhance wetlands.	Not Applicable	No federal wetlands in Corridor Site
Floodplain Management	Executive Order No. 11988	40 CFR 6.302 (b) (2005)	Regulates activities in a floodplain.	Applicable	Floodplains exist in Corridor Site

Key:
CFR = Code of Federal Regulations.
FWIA = Fish and Wildlife Impact Analysis.
NYCRR = New York Codes, Rules and Regulations.
OU = Operable Unit.
SCG = Standards, criteria, and guidelines.

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Local Action-Specific SCGs					
Lockport City Code	Demolition of Buildings	Chapter 68	Involves permitting and requirements for removal of buildings and structures.	Applicable	Applicable to removal of buildings or structures on residential properties
	Environmental Quality Review	Chapter 92	General regulations regarding environmental projects conducted within the city; requires enforcement of 6 NYCRR 617	Applicable	
	Noise	Chapter 125	Places restrictions on unnecessary noise during certain time periods.	Applicable	Potential restrictions on noise from construction equipment/vehicles.
	Parks	Chapter 129	Regulates various activities conducted in city parks.	Not Applicable	
	Sewers	Chapter 150	Regulates discharge of waters to city sewers.	Relevant and Appropriate	
	Streets and Sidewalks	Chapter 158	Regulates alterations of roads and sidewalks including excavation, widening, etc.	Relevant and Appropriate	
	Trees	Chapter 176	Regulates cutting down and planting trees on public land.	Applicable	Applies to removal of trees on the two properties owned by the City of Lockport
	Vehicles and Traffic	Chapter 183	Places restrictions on truck traffic throughout the city and defines weight limits on certain streets.	Applicable	Applicable to any transportation of wastes off site via truck.
	Water	Chapter 185	Places restrictions on access and use of city water mains.	Relevant and Appropriate	Relevant and appropriate to construction activities or technologies requiring access to water.

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Action-Specific SCGs					
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law, Articles 3 and 19	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels.	Applicable	Applicable to noise from over-the-road vehicles
Environmental Conservation Law, Articles 3 and 19	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200-202	Establishes general provisions and requires construction and operation permits for emission of air pollutants.	Relevant and Appropriate	
Environmental Conservation Law, Article 15; also Public Health Law Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257	Part 256: New York Ambient Air quality Classification System; Part 257: Air quality standards for various pollutants including particulates and non-methane hydrocarbons.	Applicable	Applicable to remediation activities at the site that include a controlled air emissions source.
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions: includes identification of "beneficial use" potentially applicable to non-hazardous oily waste/soil (360-1.15); 360-2: Regulates construction and operation of landfills, including construction and demolition debris landfills.	Applicable	Applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous soil and debris.
New York Waste Transport Permit Regulations	Permitting Regulations, Requirements and Standards for Transport	6 NYCRR 364	The collection, transport, and delivery of regulated waste, originating or terminating at a location within New York, will be governed in accordance with Part 364.	Applicable	Applicable for transporting wastes offsite
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System - General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 - 374, 376.	Applicable	Hazardous wastes have been identified at the site

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste (PCBs) and lists specific wastes.	Applicable	Applies to transportation and all other hazardous waste management practices in New York State; Hazardous material has been identified on site.
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and record keeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities.	Applicable	Relevant to transportation of hazardous material offsite
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage, and disposal of hazardous waste.	Applicable	Relevant to off-site treatment/disposal of hazardous waste
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes (Subpart 374-2 establishes standards for the management of used oil).	Applicable	Hazardous wastes have been identified on site
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act, Articles 301 and 305.	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry site; provides exception from NYSDEC permits; Part 375-6.8: Provides soil cleanup objectives used for this report.	Applicable	Part 375-6.8 provides soil cleanup objectives used for this report.
Environmental Conservation Law, Articles 3 and 27.	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes that are restricted from land disposal; Defines treatment standards for hazardous waste.	Applicable	Hazardous material has been identified on site.
New York Environmental Quality Review Regulations		6 NYCRR 617	Implements provisions of State Environmental Quality Review Act.	Applicable	

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Implementation of SPDES Program in New York	General Permit for Stormwater	6 NYCRR 750–758	Regulates permitted releases into waters of the state.	Applicable	
Primary and Principal Aquifer Determinations (5/87)		NYSDEC TOGS 2.1.3	Provides guidance on determining water supply aquifers in upstate New York.	Not Applicable	There are no primary aquifers in Niagara county.
Environmental Justice and Permitting	Environmental Justice	Commissioner Policy 29	Policy incorporates environmental justice concerns into NYSDEC's public participation provisions and application of the State Environmental Quality Review Act (SEQR).	Applicable	
Federal Action-Specific SCGs					
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions.	Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations; Includes training requirements and construction safety requirements.	Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities that fall under jurisdiction of the National Contingency Plan.
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination with Other Agencies	Delegates authority under CERCLA and the NCP to federal agencies.	Relevant and Appropriate	
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb)	Applicable	Applicable to emissions from equipment and remediation systems

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants; Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants.	Applicable	Applicable to emissions from equipment and remediation systems.
Toxic Substances Control Act	Rules for Controlling PCBs	40 CFR 761	Provides guidance on storage and disposal of PCB-contaminated materials.	Applicable	PCBs are contaminants of concern at the site.
RCRA	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste.	Applicable	Applicable to remedial alternatives that involve generation of non-hazardous waste.
	Hazardous Waste Management System - General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268.	Applicable	Applicable to remedial alternatives that involve generation of a hazardous waste (e.g., contaminated soil);
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes that are subject to regulation as hazardous wastes.	Applicable	
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste.	Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards that apply to persons transporting manifested hazardous waste within the United States.	Applicable	Applicable to alternatives involving off-site disposal of hazardous wastes.
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards that define acceptable management of hazardous waste.	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Standards for Owners of Hazardous Waste Facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities.	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities.

Table 4-2 Action-Specific SCGs, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal.	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
	Hazardous Waste Permit Program	40 CFR 270, 124	EPA administers hazardous waste permit program for CERCLA/Superfund Sites; Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.	Relevant and Appropriate	Relevant and appropriate to offsite hazardous waste disposal facilities
Clean Water Act	EPA Pretreatment Standards	40 CFR 403	Establishes responsibilities of federal, state, and local government to implement national pretreatment standards to control pollutants that pass through to a POTW	Relevant and Appropriate	Applies if discharge is made to a POTW

Key:

CERCLA	=	Comprehensive Environmental Response, Compensation, and Liability Act.
CFR	=	Code of Federal Regulations.
EPA	=	(United States) Environmental Protection Agency.
NYCRR	=	New York Codes, Rules and Regulations.
NYSDEC	=	New York State Department of Environmental Conservation.
OSHA	=	Occupational Safety and Health Administration.
OU	=	Operable Unit.
PCB	=	Polychlorinated biphenyl.
PCE	=	Perchloroethylene.
POTW	=	Publicly Owned Treatment Works.
RCRA	=	Resource Conservation and Recovery Act.
SCG	=	Standards, criteria, and guidelines.
SEQR	=	State Environmental Quality Review Act
SPDES	=	State Pollutant Discharge Elimination System.
TCE	=	Trichloroethylene.
TOGS	=	Technical and Operational Guidance Series.

Table 4-3 Cleanup Goals for Soils, OU-6 Water Street Residential Properties, Eighteenmile Creek Corridor Site, Lockport, New York

Analyte	NYSDEC Cleanup Goals[a] Protection of Public Health - Residential	NYSDEC Cleanup Goals[a] Protection of Ecological Resources	NYSDEC Cleanup Goals[a] Unrestricted Use	NYSDEC TAGM 4046[b]	Site Background[c]	New York State Background[d]	Maximum Concentration[e]	Reference RI[f]	Reference SRI[g]	Selected Cleanup Goal
Total PCB by Method 8082 (mg/kg)										
Total PCBs	1	1	0.1	1 / 10	-	-	27.0	X		**1**
SVOCs by method SW8270C (mg/kg)										
Benzo(a)anthracene	1	-	1	0.224	0.18	0.16	6.8 J	X		**1**
Benzo(a)pyrene	1	2.6	1	0.061	0.037	0.12	7.7	X		**1**
Benzo(b)fluoranthene	1	-	1	1.1	0.24	0.36	8.4	X		**1**
Benzo(k)fluoranthene	1	-	0.8	1.1	0.12	0.1	3.1 J	X		**1**
Chrysene	1	-	1	0.4	0.23	-	6.1 J	X		**1**
Dibenzo(a,h)anthracene	0.33	-	0.33	0.014	0.044	< 0.044	1.9 J	X		**0.33**
Indeno(1,2,3-cd)pyrene	0.5	-	0.5	3.2	0.036	0.076	6.1 J	X		**0.5**
Metals by Method 6010/7471 (mg/kg)										
Antimony	-	-	-	SB	1.8	2.17	2.1 BN	X		**1.8**
Arsenic	16	13	13	7.5	6.0	12	66.5 N	X		**16**
Cadmium	2.5	4	3	1	-	2.4	7.9 N	X		**2.5**
Chromium	22	1	1	10	14.0	20	262 E	X		**22**
Copper	270	50	50	25	18.2	32	2,620 N	X		**270**
Iron	-	-	-	2,000	17,300	25,600	103,000 N	X		**2,000**
Lead	400	63	63	SB	53.1	72	4,630 E	X		**400**
Mercury	0.81	0.18	0.18	0.1	0.005	0.2	1.9 N	X		**0.81**
Thallium	-	-	-	SB	2.6	16.3	3.9	X		**3**
Zinc	2,200	109	109	20	255	140	2560 E	X		**2,200**

Notes:

Shaded values represent Contaminants of Concern (COCs)

[a] Cleanup goals obtained from 6 NYCRR Part 375-6.8 Soil Cleanup Objective Tables (NYSDEC December 14, 2006).

[b] NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 (Jan 1994) Soil Cleanup Objectives. PCB value in surface soil is 1 ppm and 10 ppm in subsurface soils.

[c] Site background values obtained from samples collected during the Site Investigation of the Former Flintkote Plant site (TVGA 2005).

[d] Background values obtained from NYS background (95th percentile), Source-Distant Data Set from NYS Brownfield Cleanup Program, Technical Support Document, Appendix D, (NYSDEC September 2006) for metals presented except thallium and antimony for which background values were obtained from Eastern United States background (95th percentile) (Shacklette and Boerngen 1984).

[e] Concentration listed is the maximum detected value from surface soil, off-bank or subsurface soil samples collected during the SRI (EEEPC 2008) and RI (NYSDEC 2006a).

[f] Maximum concentration for a particular contaminant was observed in data collected and reported in the RI Report (NYSDEC 2006a).

[g] Maximum concentration for a particular contaminant was observed in data collected and reported in the SRI (EEEPC 2008).

Key:

- B = Value greater than or equal to the instrument detection limit, but less than the contract required detection limit (inorganics).
- E = Estimated concentration due to presence of interference (inorganics).
- J = Estimated value.
- mg/kg = Milligrams per kilogram.
- N = Spike sample recovery or spike analysis is not within quality control limits (inorganics).
- NYSDEC = New York State Department of Environmental Conservation.
- OU = Operable Unit.
- PCB = Polychlorinated biphenyl.
- ppm = Parts per million.
- RI = Remedial Investigation (NYSDEC 2006a).
- SB = Site background.
- SRI = Supplemental Remedial Investigation (EEEPC 2008).
- SVOC = Semivolatile organic compound.

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Because groundwater is not a media of concern at the site, SCOs for the protection of groundwater were not considered applicable. Furthermore, ecological receptors are potentially impacted by site contamination according to the FWIA conducted for the SRI. The FWIA identified PCBs, copper, lead, and zinc as contaminants in floodplain soils that pose a potential threat to ecological receptors at the site. However, it is assumed that active remedial alternatives will include bank stabilization measures along the length of Eighteenmile Creek in order to limit upland soils from eroding to the creek. This includes soils that have contaminant concentrations below selected residential cleanup goals for soils, but above sediment guidance values. Therefore, it is assumed that these bank stabilization and active remediation measures will be protective of ecological resources and SCOs for the protection of ecological resources will not be specifically considered.

The cleanup goals for the contaminants at this site are presented in Table 4-3.

Criteria and Guidance Values

Refer to Section 3.2.4.1 for a description of Criteria and Guidance Values.

Background

Refer to Section 3.2.4.1 for a description of Background Values.

Selection Process

The selected cleanup goals for soils (surface and subsurface) are presented in Table 4-3. These values are used later in this report to calculate remedial volumes and subsequent costs. The following logical basis was used to select the preliminary cleanup values:

- 6 NYCRR Part 375-6.8 residential soil cleanup standards were selected as the cleanup goals;
- Where cleanup standards were not available, NYSDEC TAGM 4046 values were selected as the cleanup goal;
- If site background values were not available for a particular contaminant, NYS background values (NYSDEC 2006c) were used as cleanup goals;
- The maximum observed concentration for each compound was then compared to the selected cleanup goal in order to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site-related and whether cleanup is warranted.

4.2.4.2 Selection of Contaminants of Concern

Based on the cleanup goals selected above, it was determined that PCBs and select metals (arsenic, chromium, copper, lead, and zinc) are the primary COCs at OU-6.

A review of Table 4-3 indicates that several SVOCs and other metals, namely antimony, cadmium, iron, mercury, and thallium, were detected above residential use SCOs. Although individual concentrations of SVOCs exceeded cleanup goals for these contaminants, none of the samples had concentrations of Total SVOCs that exceeded the NYSDEC TAGM 4046 soil cleanup objective (500 mg/kg). (NYSDEC 2006a) Therefore, SVOCs will not be considered primary COCs. Additionally, exceedances of antimony, cadmium, iron, mercury, and thallium occurred in a few isolated locations and were typically only one to two times greater than selected SCOs. Therefore, these metals will not be considered primary COCs.

Although the contaminants listed above will not be considered primary COCs, exceedances of these contaminants were located in areas of fill and/or were co-located with exceedances of the other COCs. As such, remediation of fill material and soils exceeding residential use SCOs will also address these exceedances.

4.2.4.3 Determination of Contaminated Soil Volumes

The volume of contaminated soils at this OU was estimated using survey and analytical data collected during the RI (NYSDEC 2006a) and SRI (EEEPC 2009b). In addition, GPS data collected during additional investigations conducted by EEEPC in late 2008 were used to delineate the bankfull elevation of Eighteenmile Creek in support of these estimates. Soils that contain COCs in concentrations greater than the selected cleanup goals were determined to be contaminated. As fill material was generally found where COCs exceeded cleanup goals and considering that the receptors at this OU are residents, the extent of contaminated soil volume was defined to be whichever was greater; the volume of fill or the volume of soil exceeding cleanup goals.

Volumes of contaminated soils were estimated in the following manner:

- Contaminant concentrations were compared against the selected cleanup goals presented in Table 4-3;
- Depth of contamination at sample locations was compared to the depth of fill at the same locations, with the greater of the two depths used to estimate volumes;
- Transects were drawn perpendicular to the creek throughout the residential properties;

- Cross-sectional areas of these transects were estimated based on the maximum depth of contamination or depth of fill at these transects; and

- Volume of contaminated material between transects was estimated by averaging the cross-sectional areas of the two transects and multiplying by the distance in between.

Using the method described above, the volume of contaminated soils was estimated to be 5,800 CY for the Water Street Residential Properties. The maximum contamination depth was estimated at 5.5 feet BGS and is located on the 131 Water Street property. The total area of contamination is approximately 2.3 acres.

Furthermore, based on sampling conducted during the RI, it is assumed for costing purposes that contaminated material on the 143 Water Street parcel is hazardous. Soil samples along an ash ridge just north of this parcel failed TCLP tests for lead, characterizing this material as hazardous. TCLP tests throughout the remaining Water Street properties, including the neighboring 131 Water Street parcel, passed TCLP tests for lead and did not contain PCB concentrations greater than 50 ppm. As such, the material at the remaining parcels is assumed to be non-hazardous.

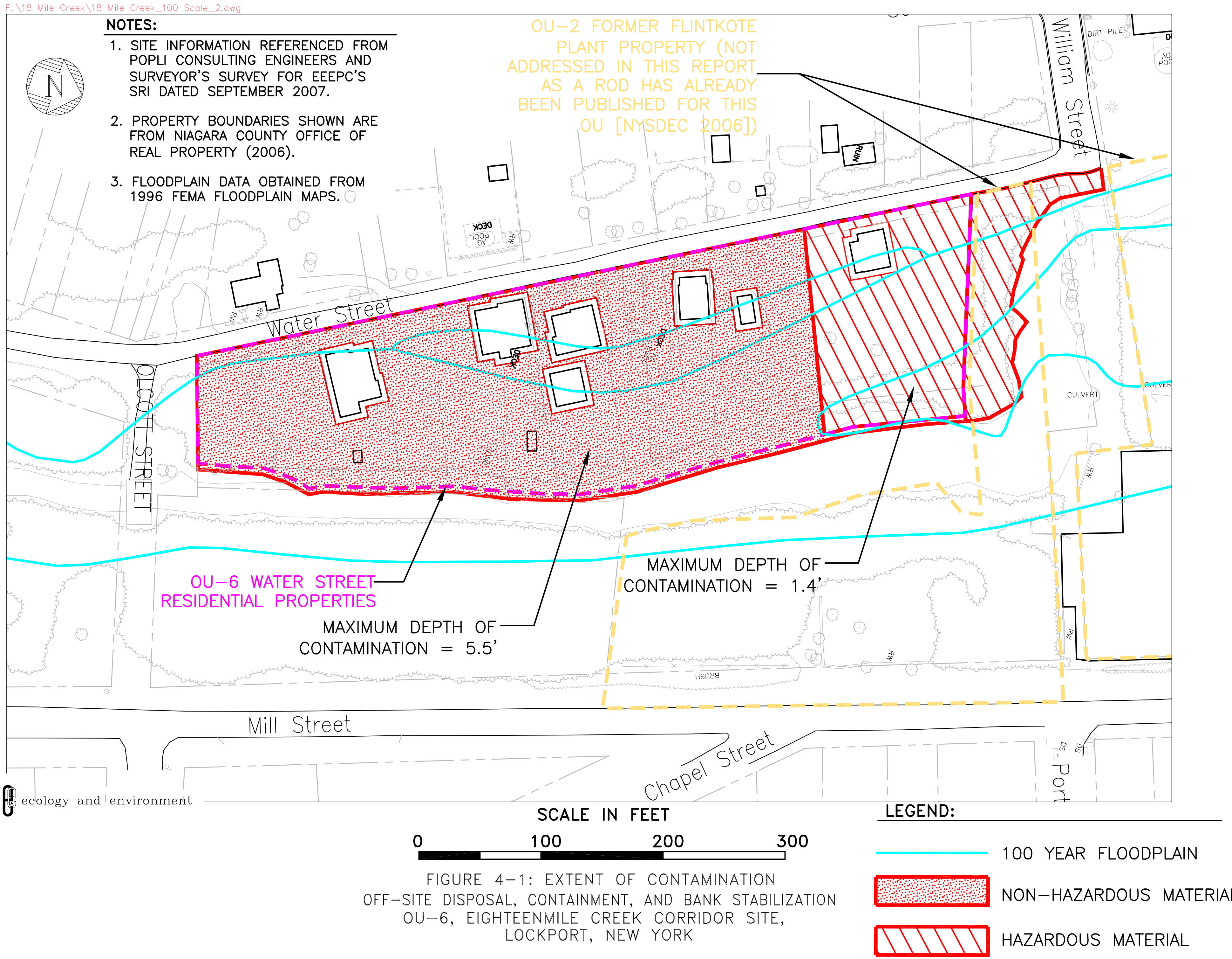
Based on the assumptions described above, the volume of hazardous material on the residential properties was estimated to be 1,000 CY, covering an area of approximately 0.3 acres. The volume of non-hazardous material was estimated to be 4,800 CY, covering an area of approximately 2 acres.

Figure 4-1 provides the extent of contamination to be further addressed in this FS for OU-6.

4.3 Identification and Screening of Remedial Technologies

This section presents the results of the preliminary screening of remedial actions that may be used to achieve the RAOs. Potential remedial actions, including GRAs and remedial technologies are evaluated during the preliminary screening on the basis of effectiveness, implementability, and relative cost. Past performance (e.g., demonstrated technology) and operating reliability were also considered in identifying and screening applicable technologies. Technologies that were not initially considered effective and/or technically or administratively feasible were eliminated from further consideration.

The purpose of the preliminary screening is to eliminate remedial actions that may not be effective based on anticipated on-site conditions or cannot be implemented at the site. The GRAs considered herein are intended to include those actions that are most appropriate for the site and, therefore, are not exhaustive.



ecology and environment

FIGURE 4-1: EXTENT OF CONTAMINATION
OFF-SITE DISPOSAL, CONTAINMENT, AND BANK STABILIZATION
OU-6, EIGHTEENMILE CREEK CORRIDOR SITE,
LOCKPORT, NEW YORK

4.3.1 General Response Actions

Based on the information presented in the RI (NYSDEC 2006a), SRI (EEEPC 2009b), and the RAOs established in Section 4.2.2, this section identifies GRAs, or classes of responses for contaminated soils. GRAs describe classes of technologies that can be used to meet the remediation objectives for contaminated site soils. As previously discussed, PCB and metals contamination in soil will be the focus of remedial actions addressed by this FS.

GRAs identified for the contaminated soils are as follows:

- No action;
- ICs;
- Containment;
- In situ treatment;
- Ex situ treatment; and
- On- and off-site disposal.

4.3.1.1 Criteria for Preliminary Screening

Refer to section 3.3.1.1 for a description of Criteria for Preliminary Screening of Technologies.

4.3.2 Identification of Remedial Technologies

This section identifies the potential remedial action technologies that may be applicable to remediation of soils at the Water Street Residential Properties (OU-6). Table 4-4 shows a summary of results from the screening of remedial technologies.

4.3.2.1 No Action

Refer to Section 3.3.2.1 for a description of the No Action Alternative.

The No Action Alternative will be further considered for detailed analysis.

4.3.2.2 Institutional Controls and Long-term Monitoring

Refer to Section 3.3.2.2 for a description of ICs and LTM technologies.

For this OU, ICs will not be evaluated independently as a stand-alone alternative because restricting access to these properties is not reasonable or practical considering their current and future residential use. LTM of site conditions will be retained in conjunction with other remedial technologies to achieve RAOs.

Table 4-4 Summary of Soil Remedial Technologies, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Screening
No Action	No further action to remedy soil conditions at the site	Ineffective for the protection of human health and the environment	Yes
Institutional Controls and LTM	Include public notification, environmental easements, fencing, and signs	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media	Yes
Containment			
Capping			
Bituminous Concrete Cover (Asphalt)	Selective excavation and/or standard asphalt cover system including layer of stone, asphalt binder course, and final wearing course	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Is more costly than soil cover and the lower permeability offered by this cover is not warranted because groundwater is not a media of concern at these OUs	No
Clay or Soil Cover	Selective excavation and/or clay or soil cover system	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media	Yes
6 NYCRR Part 360 Cover	Selective excavation and/or non-RCRA cap typically used to close Municipal Solid Waste Landfills	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Is more costly than soil cover and the lower permeability offered by this cover is not warranted because groundwater is not a media of concern at these OUs	No
6 NYCRR Part 373 (RCRA) Cover	Selective excavation and/or RCRA cap typically required at Hazardous Waste Sites	Does not reduce contamination concentrations but can reduce potential exposure to the contaminated media; Close proximity of hazardous waste to the creek limits construction of an RCRA cover	No
In Situ Treatment			
Thermal			
Thermally Enhanced Soil Vapor Extraction (SVE)	Uses electrical resistance/electromagnetic/ radio frequency heating, or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors	SVE is not effective in removing non-volatile organics such as PCBs or heavy metals	No
Thermal Desorption (thermal blankets and wells)	Thermal blankets and thermal wells are placed on contaminated ground surface; A majority of contaminants are vaporized out by thermal conduction; Vapors are drawn out by vacuum system, oxidized, cooled, and passed through activated carbon beds	More expensive than other established remedial technologies; Not effective for remediating inorganics and metals	No

Table 4-4 Summary of Soil Remedial Technologies, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Screening
Vitrification	Contaminated soils are melted at extremely high temperatures using probes inserted into the ground delivering an electric current; The soil is heated to extremely high temperatures and is cooled to form a stable, glassy crystalline mass	Only a few commercial applications of this technology exist; Treatability studies are generally required to determine the effectiveness of ISV as a remediation technology at a given site; End product of the technology may hinder future site use, and there is relatively high implementation cost	No
Physical/Chemical			
Solidification/ Stabilization	Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their "host" medium using chemical reactions instead of removing them through chemical or physical treatment	Stabilization technologies have not been successfully demonstrated on a full-scale basis for treating organics; Solidified material may hinder future site use; Treatability studies would be required prior to implementing this technology	No
Soil Flushing	An extraction process by which organic and inorganic contaminants are washed from contaminated soils through the injection of an aqueous solution into the area of contamination, and the contaminant elutriate is pumped to the surface and removed from the site	Capture of the impacted solution is critical to the effectiveness of this technology; Contamination depths and PCBs strong tendency to adhere to soil particles may limit this technology’s effectiveness.	No
Biological			
Biological Treatment	Uses indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride	Biological treatment technologies are not well-demonstrated for PCBs and are ineffective for heavy metals; This technology also involves a relatively longer remediation period compared to other treatment technologies	No
Ex Situ Treatment			
Thermal			
High Temperature Thermal Desorption	A physical separation process that uses heat to volatilize organic wastes, which are collected and treated in a gas treatment system	Moderate cost, full-scale technology that has been successfully demonstrated in the field for treatment of PCB contaminated soils; Heavy metals in the impacted soils would require additional stabilization treatment; Lack of available space on site to construct a full scale facility	No

Table 4-4 Summary of Soil Remedial Technologies, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Screening
Incineration	Uses high temperatures to volatilize and destroy organic contaminants and wastes	Has demonstrated success in treatment of PCB contaminated soils but is ineffective for treatment of high concentrations of metals; Is more expensive than other ex situ treatment technologies and would be difficult to implement on site due to a lack of space	No
Vitrification	Thermally melts contaminants at high temperatures using a gas/oxygen power source; Organics such as PCBs and VOCs are destroyed while metals are inertly captured in a crystalline structure; Soils are excavated and stockpiled, and a fluxing agent is introduced to aide in the melting process	Medium-to-high cost technology that is successful in destroying PCBs, organics, and stabilizing metals; The inert glass aggregate byproduct can be returned to the site for backfill or can be sold as a construction aggregate; However, there are no current existing vitrification plants accepting waste, and construction of an onsite facility is not feasible due to high costs and lack of available space	No
Physical/Chemical			
Dehalogenation	A chemical process that is achieved either by replacement of the halogen molecule of the organic compound or decomposition and partial volatilization of the contaminant through adding and mixing specific reagents	Although EPA has been developing this technology since 1990, it has not yet been successfully demonstrated in a commercial application and cannot be used to treat metals contamination	No
Solvent Extraction	A chemical extraction process whereby the target contaminant is physically separated from the soil using an appropriate organic solvent to dissolve PCBs; Other solvents such as acids can be used to separate heavy metals	This technology has not been commercially implemented, and may require multiple extractions so that solvent-contaminated soils are not returned to the site; Will require multiple solvents to treat both organic and inorganic contaminants; On-site implementation would be challenging due to a lack of space	No
Soil Washing	A volume reduction technology that segregates the fine solid fractions from the coarser soils through an aqueous washing process and washing water treatment system	There is not a high level of confidence in the effectiveness of soil washing of PCB contaminated soil, and the costs to construct and operate an on-site processing facility are high	No
Solidification/ Stabilization	Contaminants are physically and chemically bound to native media; Soils are excavated, stockpiled, and mixed with reagents such as asphalt or Portland cement	Is effective in reducing the mobility of metals; However, is ineffective for treatment of organic contaminants such as PCBs	No

Table 4-4 Summary of Soil Remedial Technologies, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Screening
On- and Off-site Disposal			
On-site Disposal	Requires construction of a secure landfill that meets RCRA and state requirements	There is no available space to build an onsite landfill; Construction of an onsite landfill may impact future use of the sites	No
Off-site Disposal	Involves the excavation and hauling of contaminated material to appropriate commercially licensed disposal facilities; The non-hazardous soils would go to a non-hazardous/solid waste facility, while the hazardous spoils would go to an RCRA-permitted facility	Excavation and disposal of contaminated soil at a permitted landfill is an effective method of reducing potential for direct contact with contaminated soils and future contamination of the groundwater; Backfill materials would need to be imported to fill the site.	Yes

Key:

ISV = In situ vitrification.
LTM = Long-term monitoring.
NYCRR = New York Codes, Rules, and Regulations.
OU = Operable Unit.
PCB = Polychlorinated biphenyl.
RCRA = Resource Conservation and Recovery Act.
SVE = Soil vapor extraction.
VOC = Volatile organic compound.

4.3.2.3 Containment
Refer to Section 3.3.2.3 for descriptions of containment technologies.

Covering
Since containment of contaminated soil via covering is effective in protecting human health and the environment, readily implementable, and relatively cost-effective, it will be retained for further analysis.

The type of cover system that will be further considered is a soil cover. Sampling during the SRI showed that groundwater was not a media of concern at these sites. Therefore, the low permeability offered by an asphalt cap and the cover system identified in 6 NYCRR Part 360 is not warranted. It is assumed that construction of an RCRA cover is not applicable due to the close proximity to the creek soils considered hazardous. Thus, a soil cover will be retained for further consideration in areas considered non-hazardous because it will reduce exposure to contaminated soils to achieve RAOs at a fraction of the cost of the other cover systems identified.

4.3.2.4 In Situ Treatment
Refer to Section 3.3.2.4 for descriptions of in situ treatment technologies.

In Situ Thermal Desorption – Thermal Blankets and Thermal Wells
Since the Water Street Residential Properties have high levels of lead, copper, and chromium contamination in addition to PCBs, other treatment methods would need to be applied in addition to ISTD to remediate these contaminants, resulting in much higher costs and cleanup times. Therefore, ISTD will not be retained for further consideration.

In Situ Vitrification
Since few full-scale applications of this technology exist and this technology has relatively high implementation costs, ISV will not be further considered for OU-6.

In Situ Solidification/Stabilization
Although this technology has been shown to be effective in reducing the mobility and toxicity of heavy metals, it has not been proven on a full-scale basis for treating organics and PCBs. Since the soils on the residential properties contain PCB contamination, this technology would need to be coupled with other treatments, resulting in higher costs and longer cleanup times. Therefore, in situ solidification/stabilization will not be retained for further consideration.

In Situ Soil Flushing
It is believed that in situ soil flushing is not effective in heterogeneous soils found at the OU-6 properties. Due to its limited success and difficulty in ensuring effectiveness in situ, this technology will not be considered further.

Biological Treatment

Bioremediation is known not to be effective in remediating inorganics and heavy metals and has not been well demonstrated for PCBs. As such, these technologies will not be retained for detailed analysis.

4.3.2.5 Ex Situ Treatment

Refer to Section 3.3.2.5 for descriptions of ex situ treatment technologies.

Ex Situ High-Temperature Thermal Desorption

HTTD is a demonstrated technology for treatment of PCBs, but is ineffective in treating high concentrations of metals. Therefore, additional technologies would need to be combined with HTTD treatment to fully remediate the soils at this site. This would result in high costs and additional complexities. Furthermore, ex situ HTTD is not easily implementable at this site due to a lack of available space on the OU-6 properties. Therefore, HTTD will not be retained for further detailed analysis.

Ex Situ Incineration

The effectiveness of incineration to remediate site contaminated soils would be similar to HTTD, however, at much higher costs and with additional risks regarding the treatment of metals in the waste feed. Similar to HTTD, this technology would not be easily implemented at OU-6 due to space limitations. Therefore, incineration will not be retained for further consideration.

Ex Situ Vitrification

Ex situ vitrification has been shown to be effective in remediating PCB and metals contamination. However, since there are currently no vitrification plants accepting material for treatment, a system would need to be constructed on the OU-6 properties. Therefore, due to a lack of space on the OU-6 properties and high costs of construction for an onsite facility, this technology will not be retained for further consideration.

Ex Situ Dehalogenation

Since dehalogenation has not been commercially implemented on a large scale, is expensive, and cannot be used to treat soils contaminated with metals, this technology will not be retained for further consideration.

Ex Situ Solvent Extraction

Solvent extraction has not been commercially implemented and is costly compared to other ex situ treatment technologies. Furthermore, multiple extractions would need to be performed with different solvents to remove both PCBs and metals. For these reasons, solvent extraction is not being retained for further consideration.

Ex Situ Soil Washing

There is not a high degree of confidence in the effectiveness of soil washing of PCB contaminated soil. Furthermore, the heterogenous nature of the material and type of contamination found at this site might require multiple washing procedures with various surfactants, thereby complicating the procedure and increasing costs. Implementability at the site may prove challenging due to space limitations. Therefore, although cost effective, ex situ soil washing will not be retained for further consideration.

Ex Situ Solidification/Stabilization

Since ex situ solidification and stabilization technologies are not effective in immobilizing or removing PCBs, additional treatment technologies would need to be applied in succession in order to reduce the potential for harm to human health and the environment. This would result in much higher costs than other available options as well as many uncertainties regarding treatment effectiveness. Therefore, ex situ solidification and stabilization methods will not be retained for further analysis.

4.3.2.6 On- and Off-site Disposal

Refer to Section 3.3.2.6 for a description of these disposal methods.

On-site Disposal

On-site disposal of contaminated material would involve construction of a landfill at the site properties. This is not practical or feasible due to current and anticipated future residential land use. Therefore, this technology will not be further considered.

Off-site Disposal

Disposal of contaminated materials in an off-site permitted disposal facility is a demonstrated alternative which effectively reduces exposure risks and provides long-term protection of human health and the environment. For these reasons, off-site disposal will be retained as an applicable alternative.

4.4 Identification of Alternatives

This section identifies alternatives based on the technologies presented in Section 4.3. In collaboration with NYSDEC, three alternatives were identified for the soil contamination at OU-6: Water Street Residential Properties. A detailed description and evaluation of the alternatives is presented in Section 4.5.

4.4.1 Alternative No. 1: No Action

The No Action Alternative was carried through the FS for comparison purposes as required by the NCP. This alternative would be acceptable only if it is demonstrated that the contamination at the site is below the RAOs or that natural processes will reduce the contamination to acceptable levels. This alternative does not include ICs.

4.4.2 Alternative No. 2: Limited Excavation and Off-site Disposal, Containment, Bank Stabilization, and LTM

This alternative consists of limited excavation of soils that are considered hazardous and containment (in-place) of soils that exceed SCOs but are considered non-hazardous. Excavated hazardous material will be transported off-site and properly disposed at an RCRA-permitted hazardous waste disposal facility. The remaining areas with soils exceeding SCOs will be contained in place by a cover system to reduce exposure to contaminated soils. Bank stabilization measures will be implemented to limit erosion of upland soils to the creek. This will reduce the risk of recontaminating creek sediments. Since material with contaminant concentrations above residential cleanup goals will remain on site, ICs such as environmental easements will need to be implemented to limit the future risk to property owners, workers, and visitors. LTM will be performed to assess whether contaminated soils are migrating to Eighteenmile Creek.

4.4.3 Alternative No. 3: Complete Excavation and Off-site Disposal, Bank Stabilization, and LTM

This alternative consists of complete excavation of on-site soils exceeding SCOs. Contaminated soils will be disposed off-site in appropriate disposal facilities. As in Alternative 2, handling and disposal of hazardous material will be performed according to RCRA regulations. Non-hazardous soils will be segregated from hazardous soils and will be disposed of in an approved disposal facility. Bank stabilization measures and LTM will be similar to those described in Alternative 2.

4.5 Detailed Analysis of Alternatives

4.5.1 Introduction

The purpose of the detailed analysis of remedial action alternatives is to present the relevant information for selecting a remedy for the site. In the detailed analysis, the alternatives established in Section 4.4 are described in detail and evaluated on the basis of environmental benefits and costs using criteria established by NYSDEC in TAGM 4030, Draft DER-10, and 6 NYCRR Part 375. This approach is intended to provide needed information to compare the merits of each alternative and select an appropriate remedy that satisfies the RAOs for the site.

4.5.1.1 Detailed Evaluation of Criteria

Refer to Section 3.5.2 for a summary of the ten evaluation criteria used to evaluate the alternatives.

A detailed description of the alternatives listed in Section 4.4 and evaluation criteria are described below. Cost estimates for each alternative are presented in Tables 4-5 and 4-6. Table 4-7 presents a summary of these costs.

4.5.2 Remedial Alternatives

4.5.2.1 Alternative No. 1: No Action

4.5.2.1.1 Description

The No Action Alternative involves taking no further action to remedy site conditions. The NCP at 40 CFR §300.430(e) (6) provides that the No Action Alternative be considered at every site as a baseline for comparison with other alternatives. This alternative does not include remedial action, institutional or engineering controls, or LTM.

Table 4-5 Cost Estimate, Alternative 2 - Limited Excavation, Offsite Disposal, Containment, Bank Stabilization, and LTM, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Institutional Controls	Environmental Easements	1	LS	$50,000	$50,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$50,000	$50,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	130	Day	$800	$104,000
Community Air Monitoring	Particulate meters	4	Ea	$7,555	$30,300
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	1	Setups	$3,000	$3,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	65	Day	$1,600	$104,000
Traffic Control (Labor)	For roads adjacent to the residential properties, including Water St. Assume 1 person for 25% of project duration	33	Day	$600	$19,500
Remove / Relocate Existing Temporary Structures	Move sheds, pools, etc.	1	LS	$25,000	$25,000
Site Clearing					
Cut and chip heavy trees	Large trees and dense vegetation found along the creek banks; Assume 50% of entire property surface area	1	Acre	$12,300	$13,900
Grub stumps and remove - heavy	Large trees and dense vegetation found along the creek banks; Assume 50% of entire property surface area	1	Acre	$6,525	$7,400
Staging Area Construction	(Staging area construction costed in Section 3 cost estimates as part of the upland terrestrial properties are not duplicated here)				
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr	1,000	BCY	$1.54	$1,600
Material Transportation On-site (from excavation to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	1,150	LCY	$3.73	$4,300
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	23	EA	$300	$6,800
Disposal Sampling	PCBs, metals and TCLP metals analysis	2	EA	$510	$1,100
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	1,500	Ton	$25.00	$37,500
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	1,500	Ton	$165	$247,500
Backfill and Site Restoration (of Excavated Areas)					
Fill (Material incl. 6" of top soil at surface)		1,150	LCY	$16.25	$18,700
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	1,150	LCY	$24.00	$27,600
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	1,150	LCY	$1.85	$2,200
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	1,000	ECY	$2.82	$2,900
Finish grading, large area	Steep slopes	14	MSF	$22.50	$400
Hydroseeding large areas		1,567	SY	$0.39	$700
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI); 25% of excavated areas	6	Ea	$162	$1,000
Replace / Relocate Existing Temporary Structures		1	LS	$25,000	$25,000
Containment					
High Visibility Demarcation Layer		97,900	SF	$0.30	$29,400
Clean soil	Total of 2' thick over areas of contamination not excavated, including 6" of topsoil for planting	7,139	LCY	$16.25	$116,000
Haul Soil	12 CY dump truck, 20 miles round trip, 0.4 load/hr	7,139	LCY	$24.00	$171,400
Spread Soil	Spread dumped material, no compaction	7,139	LCY	$1.85	$13,300
Compact Soil	12" lifts, vibrating roller; incl cut-back volume	6,207	ECY	$2.82	$17,600
Finish grading, large area	Steep slopes	84	MSF	$22.50	$1,900
Hydroseeding large areas		9,311	SY	$0.39	$3,700
Geotextile Fabric	For additional protection along the creek banks at a width of 10'	9,311	SY	$2.58	$24,100
Clean Stone	Assume 1' layer thick at a width of 10' over the geotextile fabric	370	LCY	$55.00	$20,400
Bank Stabilization (of Excavated Areas)					
Jute Mesh (Erosion Control Mat)		222	SY	$1.60	$400
Plantings (Shrubs)	Low shrubs along the bank, assume 1 shrub every 3'	33	Ea	$81.00	$2,700
				Capital Cost Subtotal:	$1,210,300
	Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):				$1,199,500
	25% Legal, administrative, engineering fees, construction management:				$299,900
				25% Contingencies:	$374,900
				Capital Cost Total:	**$1,874,300**
				Capital Cost Total (2009 Dollars):	**$1,932,000**
Annual Costs					
Site monitoring	Visual survey creek banks, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Reporting		20	HR	$100	$2,000
				Annual Cost Subtotal:	$6,000

Table 4-5 Cost Estimate, Alternative 2 - Limited Excavation, Offsite Disposal, Containment, Bank Stabilization, and LTM, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):					$6,000
10% Legal, administrative, engineering fees:					$600
25% Contingencies:					$1,700
Annual Cost Total:					**$8,300**
30-year Present Worth of Annual Costs:					**$169,200**
30-year Present Worth of Annual Costs (2009 Dollars):					**$175,000**
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$200	$200
Cover Maintenance (replacing soil, geotextile)	Assume 5% of initial cover cost	1	LS	$19,900	$19,900
Institutional Controls	Maintain / Update Documentation	1	LS	$25,000	$25,000
Periodic Cost Subtotal:					$53,100
Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):					$52,700
10% Legal and Administrative Fees:					$5,300
25% Contingencies:					$14,500
Periodic Cost Total:					**$72,500**
30-year Present Worth of Periodic Costs:					**$311,600**
30-year Present Worth of Periodic Costs (2009 Dollars):					**$322,000**
2009 Total Present Worth Cost:					**$2,429,000**

Notes:

1. Assume staging area at the White Transportation property will be used.
2. Estimated Volume of Hazardous Fill and Soil (143 Water St. parcel) — 1,000 BCY
3. Estimated Volume of Fill and Non-Hazardous Soils (remaining parcels) — 4,800 BCY
4. Estimated Surface Area of Hazardous Material — 14,100 SF
5. Estimated Surface Area of Non-hazardous Material and Cover Area — 83,800 SF
7. Estimated Length of Creek adjacent to properties — 1,000 LF
8. Assume verification sampling grid spacing: — 25 ft
9. Construction Duration (Assuming 5 day work week)

   Total Project Time — 6 mo

   1 construction season
10. Conversion from BCY to LCY (dewatered material): — 1.15 LCY/BCY
11. Conversion from BCY to tons (dewatered material): — 1.5 tons/BCY
12. Conversion from BCY to LCY (saturated material): — 1.12 LCY/BCY
13. Conversion from BCY to tons (saturated material): — 1.7 tons/BCY
14. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).
15. Costs presented are based on conventional contracting methods.
16. Assume tree planting grid spacing every — 25 ft
17. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Key:
BCY = Bank cubic yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards.
LF = Linear feet.
LS = Lump sum.
Mo = Month.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 4-6 Cost Estimate, Alternative 3 - Complete Excavation, Off-site Disposal, Bank Stabilization and LTM, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Capital Costs					
Work Plan / Final Report	Includes submittals, meetings	1	LS	$25,000	$25,000
Site Preparation and Engineering Controls					
Mobilization/Demobilization	Include site prep, trailers, staging ,etc. and demobilization	1	LS	$50,000	$50,000
Health and Safety requirements	Officer; assume on-site 100% of project duration	130	Day	$800	$104,000
Community Air Monitoring	Particulate meters	4	Ea	$7,555	$30,300
Decontamination Pad & Containment	For equipment, personnel, and departing site vehicles	1	Setups	$3,000	$3,000
Surveying	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	65	Day	$1,600	$104,000
Traffic Control (Labor)	For roads adjacent to the residential properties, including Water St. Assume 1 person for 25% of project duration	33	Day	$600	$19,500
Site Clearing					
Cut and chip heavy trees	Large trees and dense vegetation found along the creek banks; Assume 50% of entire property surface area	1	Acre	$12,300	$13,900
Grub stumps and remove - heavy	Large trees and dense vegetation found along the creek banks; Assume 50% of entire property surface area	1	Acre	$6,525	$7,400
Remove / Relocate Existing Temporary Structures	Sheds, pools, etc.	1	LS	$25,000	$25,000
Staging Area Construction	(Staging area construction costed in Section 3 cost estimates as part of the upland terrestrial properties are not duplicated here)				
Soil Removal					
Soil Excavation	Hydraulic Excavator, 2 C.Y. bucket; 165 C.Y./hr	5,800	BCY	$1.54	$9,000
Material Transportation On-site (from excavation to staging area)	12 CY Dump truck, 0.5 mi roundtrip, 3.7 loads / hr	6,670	LCY	$3.73	$24,900
Verification Sampling	PCBs and metals analysis, assumes 24-hr turnaround	157	EA	$300	$47,000
Disposal Sampling	PCBs, metals and TCLP metals analysis	10	EA	$510	$5,100
Transport to Disposal Facility (Non-haz)	assumes 28 tons/load transport to Chaffee Landfill in Chaffee, NY	7,200	Ton	$13.00	$93,600
Disposal at Disposal Facility (Non-haz)	Non-hazardous material	7,200	Ton	$26.00	$187,200
Transport to Disposal Facility (Haz)	assumes transport of material from Eighteenmile Creek to Model City, NY	1,500	Ton	$25.00	$37,500
Disposal at Disposal Facility (Haz)	Hazardous material either for PCBs or Lead	1,500	Ton	$165	$247,500
Backfill and Site Restoration (of Excavated Areas)					
Fill (Material incl. 6" of top soil at surface)		6,670	LCY	$16.25	$108,400
Haul Fill	12 CY dump truck, 20 miles round trip, 0.4 load/hr	6,670	LCY	$24.00	$160,100
Spread Fill	Spread dumped material, no compaction; incl cut-back volume	6,670	LCY	$1.85	$12,400
Compact Fill	12" lifts, vibrating roller; incl cut-back volume	5,800	ECY	$2.82	$16,400
Finish grading, large area	Steep slopes	98	MSF	$22.50	$2,300
Hydroseeding large areas		10,878	SY	$0.39	$4,300
Plantings (Trees)	Assume Norway Maple is representative (Based on SRI); 25% of excavated areas	39	Ea	$162	$6,400
Replace / Relocate Existing Temporary Structures		1	LS	$25,000	$25,000
Bank Stabilization					
Jute Mesh (Erosion Control Mat)		2,222	SY	$1.60	$3,600
Plantings (Shrubs)	Low shrubs along the bank, assume 1 shrub every 3'	333	Ea	$81.00	$27,000
		Capital Cost Subtotal:			$1,399,800
Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):					$1,387,202
25% Legal, administrative, engineering fees, construction management:					$346,900
25% Contingencies:					$433,600
Capital Cost Total:					**$2,167,800**
Capital Cost Total (2009 Dollars):					**$2,234,000**
Annual Costs					
Site monitoring	Visual survey of creek banks, etc., assume 2-persons @ $100/hr; 10 hr/day	2	Events	$2,000	$4,000
Data Reporting		20	HR	$100	$2,000
Annual Cost Subtotal:					$6,000
Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):					$5,946
10% Legal and Administrative Fees:					$595
25% Contingencies:					$1,700
Annual Cost Total:					**$8,300**
30-year Present Worth of Annual Costs:					**$169,200**
30-year Present Worth of Annual Costs (2009 Dollars):					**$175,000**
Periodic Costs (Every 5 Years)					
5-yr Review, Data Evaluation, and Reporting		80	HR	$100.00	$8,000
Bank Stabilization Repair	Assume 5% of initial cost for bank stabilization	1	LS	$1,400	$1,400
Periodic Cost Subtotal:					$9,400

Table 4-6 Cost Estimate, Alternative 3 - Complete Excavation, Off-site Disposal, Bank Stabilization and LTM, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Comments	Quantity	Units	Unit Cost	Cost
Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (0.991):					$9,315
10% Legal and Administrative Fees:					$1,000
25% Contingencies:					$2,600
Periodic Cost Total:					**$13,000**
30-year Present Worth of Periodic Costs:					**$62,900**
30-year Present Worth of Periodic Costs (2009 Dollars):					**$65,000**
2009 Total Present Worth Cost:					**$2,474,000**

Notes:

1. Assume staging areas at the White Transportation property will be used.		
2. Estimated Volume of Hazardous Fill and Soil (143 Water St. parcel)	1,000	BCY
3. Estimated Volume of Fill and Non-Hazardous Soils (remaining parcels)	4,800	BCY
4. Estimated Surface Area of Hazardous Material (estimated based on extent of contamination shown on Figure 4-1)	14,100	SF
5. Estimated Surface Area of Non-hazardous Material (estimated based on extent of contamination shown on Figure 4-1)	83,800	SF
6. Estimated Length of Creek adjacent to properties	1,000	LF
7. Assume verification sampling grid spacing:	25	ft
8. Construction Duration (Assuming 5 day work week)		
Total Project Time	6	mo
	1	construction season
9. Conversion from BCY to LCY (dewatered material):	1.15	LCY/BCY
10. Conversion from BCY to tons (dewatered material):	1.5	tons/BCY
11. Conversion from BCY to LCY (saturated material):	1.12	LCY/BCY
12. Conversion from BCY to tons (saturated material):	1.7	tons/BCY

13. 30-year present worth of costs assumes 2.7% annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 August 2000) and the Office of Management and Budget Real Discount Rates for the year 2008 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).

14. Costs presented are based on conventional contracting methods.

15. Assume tree planting grid spacing every 25 ft

17. RS Means Historical Cost Index used to escalate 2008 costs to 2009 costs:

Year	Index #
2008	180.4
2009	185.9

Key:
BCY = Bank cubic yards.
EA = Each.
ECY = Embankment cubic yards.
HR = Hour.
kGal = Thousand gallons.
LCY = Loose cubic yards.
LF = Linear feet.
LS = Lump sum.
Mo = Month.
MSF = 1000 square feet.
OU = Operable Unit.
SF = Square feet.
SY = Square yards.
WWTP = Wastewater treatment plant.

Table 4-7 Summary of Total Present Worth Values of Alternatives, OU-6, Eighteenmile Creek Corridor Site, Lockport, New York

Description	Alternative 1 No Action	Alternative 2 Limited Excavation, Offsite Disposal, Containment, Bank Stabilization, and LTM	Alternative 3 Complete Excavation, Offsite Disposal, Bank Stabilization, and LTM
Total Project Duration (Years)	0	30	30
Capital Cost	$0	$1,932,000	$2,234,000
30-year Present Worth of Annual O&M Costs	$0	$175,000	$175,000
30-year Present Worth of Periodic O&M Costs	$0	$322,000	$65,000
2009 Total Present Value of Alternatives	**$0**	**$2,429,000**	**$2,474,000**

Note:

All costs are presented in 2009 Dollars.

4.5.2.1.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is not protective of human health and the environment because the site would remain in its present condition. Soils exceeding target risk levels and regulatory levels will continue to exist at the site and will be available for potential future exposure to human and ecological receptors. Direct contact and ingestion of contaminated soils may pose a risk to nearby residents and wildlife. Furthermore, the No Action Alternative does not address transport mechanisms, such as erosion and surface runoff that would allow soils at these properties to continue to serve as potential sources of contamination to Eighteenmile Creek.

Compliance with SCGs

Site contaminants (PCBs and metals) are resistant compounds by nature and are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site.

Short-term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved.

This alternative does not include source removal or treatment and would not meet the RAOs (as defined in Section 4.2.2) in a reasonable or predictable timeframe.

Long-term Effectiveness and Permanence

Because this alternative does not involve removal or treatment of the contaminated soil, risks associated with direct contact and ingestion with the soil, and migration of contaminants to creek sediments will essentially remain the same. This alternative is, therefore, not effective in the long-term.

Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative does not involve removal or treatment of contaminated soil; therefore, the toxicity, mobility, and volume of contamination will not be reduced.

Implementability

There are no actions to implement under this alternative.

Cost

There are no costs associated with this alternative.

Land Use

The Water Street Residential Properties include 9 parcels ranging from 93 Water Street to 143 Water Street. These properties are currently occupied by residents and consist of single family homes. It is assumed that the future use of these properties will continue to be residential. Implementation of this alternative would not impact current or anticipated future land uses at these properties as no remedial actions are associated with this alternative. However, site risks will remain as they are currently.

4.5.2.2 Alternative No. 2: Limited Excavation and Off-site Disposal, Containment, Bank Stabilization, and LTM

4.5.2.2.1 Description

This alternative involves limited excavation and off-site disposal of soils considered hazardous and containment (in place) of soils that exceed SCOs but are considered non-hazardous for PCBs and/or metals contamination. As defined by 40 CFR 261, soils with concentrations of PCBs greater than 50 ppm and soils with metals concentrations that exceed the TCLP test limits are considered hazardous. The locations of the areas to be excavated are presented in Figure 4-2. The excavation will extend to depth to include fill material regardless of analytical data.

As portions of the site are located within the 100-year floodplain, an evaluation would need to be performed to determine the impacts of raising grades at the site due to construction of a cover, prior to implementation of this alternative. Pending results from this evaluation that indicate placement of a cover at this site would be acceptable, this alternative can be readily implemented as follows.

The volume of hazardous material to be removed was estimated based on sampling data presented in the SRI (EEEPC 2009b). The SRI concluded that no correlation could be determined between contaminant concentrations and TCLP test failures, which would characterize the waste as hazardous. Therefore, it was assumed for the purposes of this FS that hazardous material was confined to localized areas where sampling indicated failure of TCLP tests for metals, or where PCB concentrations were greater than 50 ppm. These areas are indicated in Figure 4-2. In the field, all soils will be subject to characterization sampling, which will determine whether or not the material is treated as hazardous.

Prior to implementation of this alternative, temporary access roads will need to be constructed. For costing purposes, it is assumed that the fenced staging area constructed for OU-3, OU-4, and OU-5 will be used (see Figure 3-3). In addition, small structures on the residents' properties (pools, sheds, etc.) may need to be relocated.

Excavation of the contaminated soil will be performed using conventional construction equipment such as hydraulic excavators and bulldozers. To ensure safe working conditions in the excavation at all times, cutback of the excavation areas may be required. The volume of the cutback material to be excavated is considered minor in comparison to the contaminated soil volume and was, therefore, not considered in the cost estimate. This soil will be staged separately from contaminated materials and used as site backfill.

During the excavation process, sampling will be conducted for metals and PCBs. TCLP tests will also need to be performed to characterize material for disposal. The results of this sampling along with the approval of NYSDEC will be used to

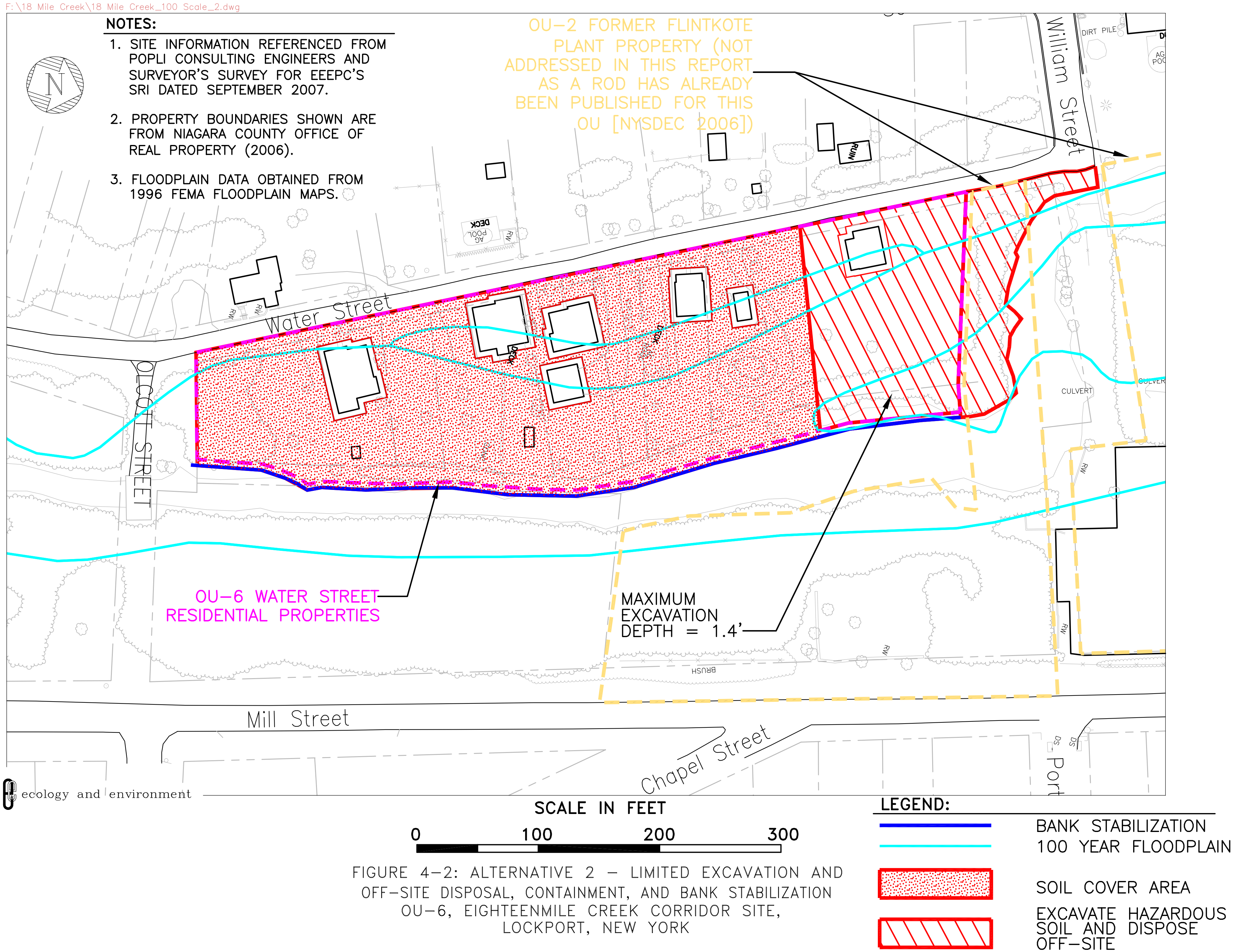


FIGURE 4–2: ALTERNATIVE 2 – LIMITED EXCAVATION AND OFF–SITE DISPOSAL, CONTAINMENT, AND BANK STABILIZATION OU–6, EIGHTEENMILE CREEK CORRIDOR SITE, LOCKPORT, NEW YORK

verify that cleanup goals have been reached in the selected areas of excavation. The goal will be to determine if the remaining soil exceeds cleanup goals, thus requiring additional excavation, or providing documentation that additional excavation is not necessary if the results indicate that the remaining soils are not above cleanup goals. A sampling grid will be developed over the soil area for NYSDEC's approval.

Handling, transport, and disposal of hazardous materials will be performed in accordance with RCRA regulations. Engineering controls will be employed to reduce short term negative impacts to the community or environment that might result from excavation of contaminated material. These will include decontamination of vehicles and personnel leaving the site as well as erosion controls such as silt fences.

Following confirmatory sampling and the approval of NYSDEC, excavated areas will be backfilled to final grade, compacted, and restored to pre-construction conditions, to the extent practicable. Since excavation will result in a significant reduction of on-site soils, clean backfill material will need to be imported to the site. The top 6 inches of backfill will be a layer of topsoil, which will be seeded with grasses and planted with trees and shrubs.

Soils that exceed SCOs but are not considered hazardous will remain on site but will be covered in place by a 2-foot-thick clean soil cover. A geotextile or similar barrier will be placed above the remaining contaminated soil and will serve as a demarcation layer. The top 6 inches of the soil cover will be of sufficient quality to support vegetation.

Bank stabilization measures will be installed along the creek banks to limit remaining onsite contaminated soils from eroding to Eighteenmile Creek. For costing purposes, it was assumed that these will be constructed from the bankfull elevation to 10-feet upland, and will consist of a woven geotextile followed by a 1-foot-thick layer of clean stone in areas where the soil cover was placed. In areas where material was excavated, it is assumed for costing purposes that the banks will be stabilized with plantings.

Temporary access roads will be removed and the disturbed areas will be restored to the pre-construction conditions, to the extent practicable. This will include placement of backfill as necessary, followed by seeding and planting of native shrubs and trees. Smalls structures on the residential properties such as pools and sheds that may have been temporarily relocated for excavation will need to be replaced.

Since contaminated material above the selected cleanup goals will remain on site, LTM will need to be performed. Under this alternative, LTM will consist of annual inspection and repair of the bank stabilization measures. In addition, monitoring and maintenance of the soil covers will need to be performed.

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required at the site.

4.5.2.2.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment since contaminated soils would either be removed from the site or contained in place. Although some contaminated material above the cleanup goals would remain on-site, this material would be contained in place by a 2-foot-thick soil cover, thereby reducing the potential for exposure by human and ecological receptors. Bank stabilization measures will limit contaminated soils from eroding to the creek.

Compliance with SCGs

This alternative will not meet chemical-specific SCGs, since some soils exceeding the selected cleanup goals will remain onsite. Applicable action- and location-specific SCGs will be achieved through the use of engineering and ICs during excavation and covering activities.

Short-term Impacts and Effectiveness

Several short-term impacts to the residents, workers, and surrounding community may arise during excavation of contaminated soil from these properties. Intrusive activities may expose workers and residents to contaminants and the potential exists for direct contact with contaminated material. Residents will likely be disrupted during construction. There is also the risk that construction activities will damage or destroy private property. With this alternative, there is an increased risk to workers due to the use of heavy equipment required to excavate the soil. Community impacts include dust and noise from equipment operation.

To minimize these short-term impacts, site access will be restricted during excavation and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels for the site will be set prior to any intrusive activities, and an appropriate corrective action will be implemented if these action levels are exceeded.

This alternative will achieve two of the three RAOs at the completion of this work. Installation of a cover and excavation of hazardous soils is anticipated to be completed within six months to a year. Additional time would be needed for engineering design, mobilization, and demobilization.

Long-term Effectiveness and Permanence

This alternative is considered to be moderately effective in the long term, as long as proper inspection and maintenance is conducted. Since some contaminated soils above the selected cleanup goals will remain onsite, the risk of exposure to human and ecological receptors will exist. However, diligent inspection and maintenance of the soil cover and bank stabilization measures will mitigate these risks.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment. However, excavation and off-site disposal of contaminated soils will reduce the volume of contaminated soil at the site. Since these soils will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. Some challenges may arise due to the lack of space on the site properties. This may present a particular problem for construction of staging areas and support facilities. However, it is assumed for this study that the nearby White Transportation property has enough available space for these needs. Other implementation issues include difficulty excavating around buried gas and water lines leading into the houses on these properties.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $2,429,000. Table 4-5 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means Cost Data series, ECHOS, quotes from contractors, and engineering judgment. Maintenance of bank stabilization measures and the soil cover are assumed with this alternative

Land Use

The Water Street Residential Properties include 9 parcels ranging from 93 Water Street to 143 Water Street. These properties are currently occupied by residents and consist of single family homes. It is assumed that the future use of these properties will continue to be residential. Although this alternative does not meet chemical-specific SCGs, contaminated soil that is left in place will be effectively covered, thereby reducing exposure risks. However, restrictions will need to be placed on the properties thereby potentially impacting the future land use of these properties.

4.5.2.3 Alternative No. 3: Complete Excavation and Off-site Disposal, Bank Stabilization, and LTM

4.5.2.3.1 Detailed Description

This alternative is similar to Alternative 2 with the exception that both hazardous and non-hazardous material exceeding selected cleanup goals will be excavated and disposed off site. The excavation areas are presented in Figure 4-3.

Excavation, material staging, and off-site disposal of material will be performed as described in Alternative 2. Material considered hazardous will be segregated from non-hazardous material at the staging area, characterized, and disposed off site at an appropriate disposal facility. Cutback material will be staged separately from contaminated materials and used as site backfill.

Excavated areas will be backfilled to final grade, compacted, and restored to pre-constructions conditions, to the extent practicable. Since excavation will result in a significant reduction of on-site soils, clean backfill material will need to be imported to the site. The top 6 inches of backfill will be a layer of topsoil, which will be seeded with grasses and planted with trees and shrubs.

Bank stabilization measures and long-term monitoring will be performed as is described in Alternative 2. Since all fill material and soils above residential use SCOs will be removed, bank stabilization will consist of jute mesh and plantings.

Under CERCLA 121 (c), five-year reviews should be conducted for sites that implement remedial actions that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Since the implementation of this alternative will result in PCBs and metals contamination above the 6 NYCRR Part 375 unrestricted use SCOs remaining on site, five-year reviews may be required.

4.5.2.3.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment since contaminated soils will be removed from the site and properly disposed of in an acceptable facility. The contaminated soil will no longer present an exposure risk to human and ecological receptors. Bank stabilization measures will limit the erosion of soils and reduce the environmental risk to the creek to the maximum extent practicable.

Compliance with SCGs

This alternative complies with SCGs because contaminated soils will be removed from the site and properly disposed of in an acceptable facility. Off-site disposal will comply with all applicable land disposal restrictions and analytical requirements. Action- and location-specific SCGs will be complied with during implementation of this alternative.

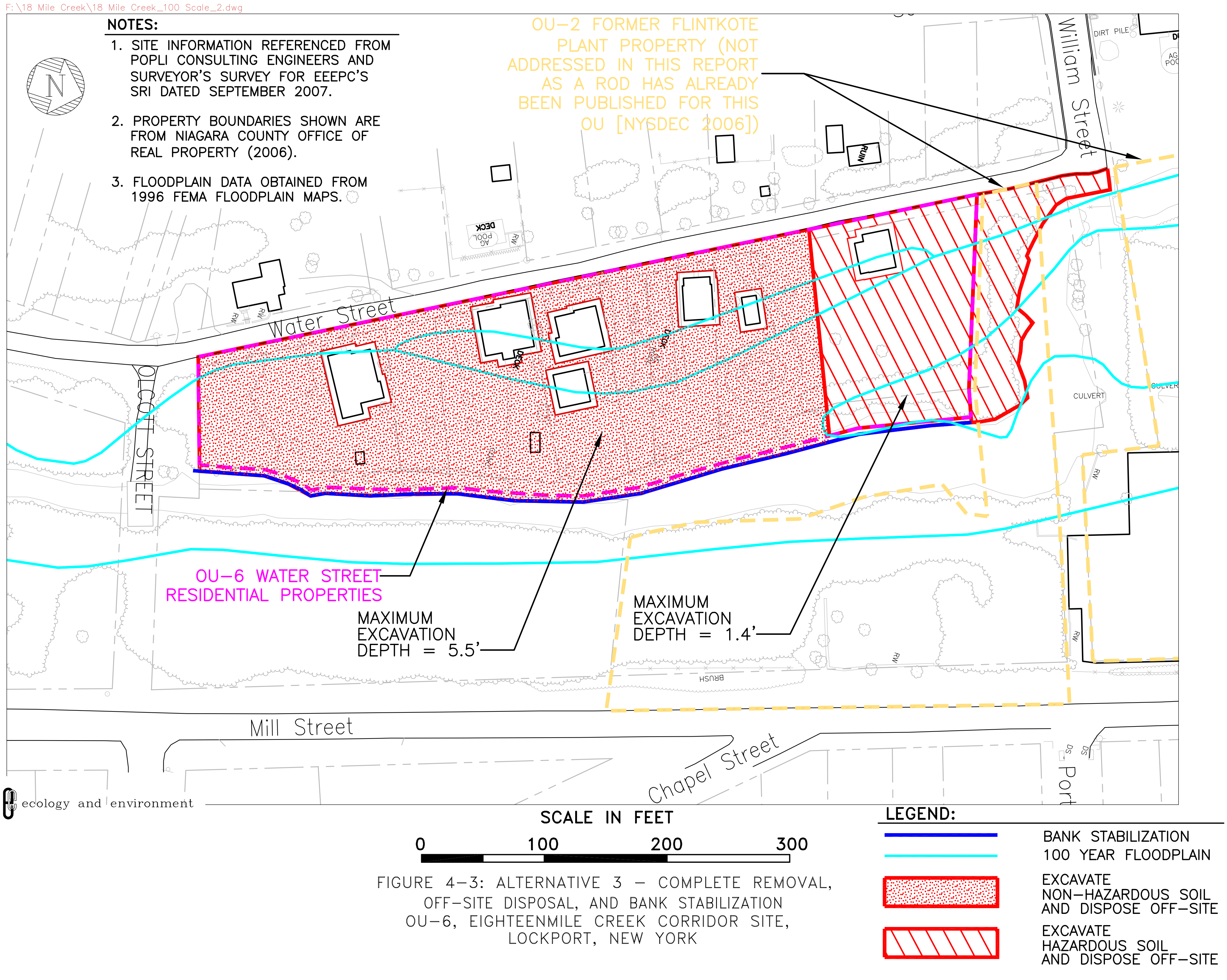


FIGURE 4–3: ALTERNATIVE 3 – COMPLETE REMOVAL, OFF–SITE DISPOSAL, AND BANK STABILIZATION OU–6, EIGHTEENMILE CREEK CORRIDOR SITE, LOCKPORT, NEW YORK

Short-term Impacts and Effectiveness

Several short-term impacts to the residents, workers, and community may arise during excavation of contaminated soil at the properties. These include dust, noise, and potential spills during handling and transportation of contaminants. Since construction will be performed on residential properties, there is the risk of damage and destruction of private property. Additionally, residents may be disrupted by remedial activities.

To minimize short-term impacts, site access will be restricted to the extent practicable during construction and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded. Off-site transportation of contaminated soil to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be limited by using closed and lined containers for transport.

Because this alternative involves removal of the contaminated soil from the site and replacement with clean fill, site RAOs will be achieved at the completion of this work. The time to complete this alternative is estimated to be approximately six months to one year. Additional time for engineering design, mobilization, and demobilization would also be required.

Long-term Effectiveness and Permanence

Removal and off-site disposal is considered to be an adequate and effective remedy in the long-term since the contaminated soil will no longer represent an environmental risk.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment. However, excavation and off-site disposal of contaminated soils will eliminate concerns associated with toxicity and mobility of the contaminants at the site. Because the contaminated soil will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. Local disposal facilities accepting hazardous and non-hazardous wastes have been identified and the capacity of these facilities can easily accommodate the volume of material to be excavated. Environmental remediation contractors and licensed trucking companies for transport of wastes are also readily available.

Some challenges may arise due to the lack of space on the residential properties. This may present a particular problem for construction of staging areas and support facilities. However, it is assumed for this study that the nearby White Transportation property has enough available space for these needs. Other implementation issues include difficulty excavating around buried gas and water lines leading into the houses on these properties.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $2,474,000. Table 4-6 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from the 2008 RS Means Cost Data series, ECHOS, quotes from contractors, and engineering judgment. Maintenance of bank stabilization measures is assumed with this alternative.

Land Use

The Water Street Residential Properties include nine parcels ranging from 93 Water Street to 143 Water Street. These properties are currently occupied by residents and consist of single family homes. It is assumed that the future use of these properties will continue to be residential. It is anticipated that the future use of these sites will not be impacted by remedial actions described in this alternative as contaminated soils will be removed from the properties and the land restored.

4.6 Comparative Evaluation of Alternatives

Overall Protection of Human Health and the Environment

Since Alternative 1 employs no action, contaminated site soils will remain on site providing no protection for current and anticipated future exposure. Alternative 2 is more protective of human health and the environment as the hazardous material will be removed and remaining contamination will be covered to reduce exposure. Alternative 3 provides the highest level of protection as contaminated material will be excavated and disposed off site.

Compliance with SCGs

The concentrations of PCBs and metals are not expected to naturally decrease over time. Alternatives 1 and 2 do not fully comply with SCGs because contaminated soils above the cleanup goals will remain on site. Alternative 3 complies with chemical-specific SCGs since soil contamination will be excavated and properly disposed off site.

Short-term Impacts and Effectiveness

Short-term impacts are not anticipated for Alternative 1 because no remediation activities will take place. Several short-term impacts may affect the residents and surrounding community during remedial activities for Alternatives 2 and 3 such as dust and noise due to excavation of contaminated soil. There is also the potential for spills of contaminated soils and off-site tracking of contamination during transport. It is expected that engineering and administrative controls such as the use of PPE, community air monitoring, and effective decontamination of trucks will mitigate these impacts. Residents will need to be coordinated with during intrusive activities.

Long-term Effectiveness and Permanence

Since Alternative 1 employs no action, contaminated soil will remain on site providing no protection for potential future exposure. Alternative 2 is somewhat effective in the long term, as long as the soil cover and bank stabilization measures are properly maintained. Alternative 3 has the highest degree of long-term effectiveness because contaminated soils will be excavated and removed from the site.

Reduction in Toxicity, Mobility, or Volume through Treatment

Reduction in toxicity, mobility, or volume through treatment will not be achieved in any of the alternatives since no treatment is being performed. However, in Alternatives 2 and 3, the volume of contaminated material will be reduced at the site, thereby reducing concerns of toxicity and mobility. Contaminated soils will be disposed at a permitted facility designed to contain and effectively reduce contaminant mobility.

Implementability

There are no actions to implement for Alternative 1. Alternatives 2 and 3 are readily implemented using standard construction means and methods. Alternative 2 will be marginally easier to implement than Alternative 3, as it requires less intrusive activity. However, the same concerns about space limitations and disruptions to residents apply to both alternatives.

Cost

Alternative 1 has no costs associated with it. The total present value of costs associated with Alternatives 2 and 3 are essentially the same. Alternative 2 has a slightly lower capital cost than Alternative 3 but higher periodic costs due to the LTM for the cover.

Land Use

As contaminated soil will remain on site for Alternatives 1 and 2, future uses at this OU may be limited. Because of the covered areas included in Alternative 2, ICs may limit the future use of some of the properties. For Alternative 3, soils exceeding SCOs will be removed. Thus, future use at OU-6 would not be restricted.

5 Conclusions

The Eighteenmile Creek Corridor Site has been identified in historical reports as a potential source of pollutants to areas downstream. This comprehensive FS addresses reasonable approaches to remediate both soil and sediment source areas within the Site. While these source areas have been separated for discussion purposes in this report, the implementation of the remedial efforts must be considered collectively with the following in mind:

- Remediation of the Site would include addressing both soil and sediment, which would require selection of remedial alternatives for each OU;
- While a comprehensive remedial approach would be to remediate both soils and sediments, soil OUs could be remediated independently to reduce human health and ecological risks at the Site. However, it would not be beneficial to remediate sediments only, as Site soils would be a continuous source of contamination to the creek;
- There are continuing sources of contamination to the creek (CSOs, Barge Canal, etc.); however, these sources do not appear to be significant contributors of contamination to the creek sediments;
- Phasing of the remedial efforts at the Site is critical.
  - It is recommended that remediation of the upland terrestrial soils occur first, followed by sediments in order to reduce the risk of recontamination of the creek; or remediation of upland terrestrial soils and creek sediments can be performed concurrently;
  - During the remedial design/action phase, it is likely that efforts to remediate soils adjacent to the creek will be combined concurrently with remediation of creek sediments based on the logistical limitations of disturbing only upland creek banks (essentially in floodplain) or only creek banks (in the creek);
  - During the remedial design/action phase it is likely that access roads located along the creek for remediating creek sediments could be used to access contaminated soil upland areas;
  - Staging areas needed for material and equipment storage during remedial implementation for sediments (OU-1) and residential properties (OU-6)

are assumed to be already in-place during implementation of remedial efforts for OU-3, OU-4, and OU-5;

- Remedial efforts for the Site must be coordinated with remedial efforts at the Former Flintkote Plant site;

- Bank stabilization is critical to limiting the migration of Site soils to the creek because upland terrestrial soil will remain in place below SCOs but above sediment cleanup goals. To be consistent with the remedial approach presented in this FS, bank stabilization measures should be included along the Former Flintkote Plant site to limit migration of Site soils to the creek; and

- Disposal costs could be reduced for creek sediments as a CDF that is owned and operated by the USACE is located in Buffalo, NY. Disposal of sediments at this facility could cost less than disposal at a local landfill.

A summary of total costs for remedial alternatives for the Corridor Site is presented in Table 5-1.

Table 5-1 Summary of Remedial Alternatives Present Value Worth Costs

OU	Alternative 1	Alternative 2		Alternative 3	Alternative 4	Alternative 5	Alternative 6
		2a	2b				
OU-1	$0 No Action	$8,779,000 Removal & Disposal, In-channel Diversion	$13,383,000 Removal & Disposal, Dam and Pump Around	-	-	-	-
OU-3, OU-4, OU-5	$0 No Action	$1,611,000 Institutional Controls		$5,602,000 Limited Excavation & Containment	$6,536,000 Complete Excavation	$10,218,000 Limited Excavation & Complete Containment	$43,193,000 Complete Excavation (Unrestricted Use SCOs)
OU-6	$0 No Action	$2,429,000 Limited Excavation & Containment		$2,474,000 Complete Excavation	-	-	-

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